All tutorial files can also be downloaded from: **www.3dartistonline.com/files**

www.3DArtistonline.com

3DArtist

67

™

tical inspiration for the 3D community

3D prints will save your life
The innovations changing the future of medicine

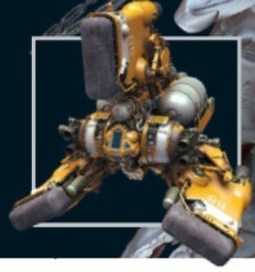
CREATE THE COVER
TURN TO PAGE 52 NOW

SHARPEN YOUR ZBRUSH SKILLS

Learn how to carve character into your digital sculpts

50 LIGHTWAVE TIPS & TRICKS

Master NewTek's software with advice from top industry pros



MODEL IN 3DS MAX

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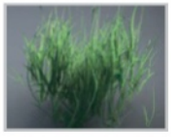

Top Blender techniques
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Monitors explored
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1. AMD FirePro™ W9100 features 16GB GDDR5 memory. Nvidia's highest memory card in the market as of April 2014 is the Quadro K6000 with 12GB GDDR5 memory. Visit http://www.nvidia.com/ content/PDF/line_card/6660-nv-prographicssolutions-linecard-july13-final-lr.pdf for Nvidia product specs. FP-90.
2. LuxMark, BASEMARK CL test details: System Description: ASUS P9X79E-WS, Intel Xeon E5-2697 v2, 32GB Kingston DDR3-2133, 750GB SSD Samsung 840EVO, Corsair AX1500i PSU, Corsair Obsidian 950D chassis, Corsair H100i CPU cooler. AMD Driver 13.35 | Nvidia Driver 332.50

> “The main focus will be battle damage, such as the rips in fabric that communicate that a hard-fought battle has taken place”

Caleb Nefzen reveals his ZBrush techniques **Page 52**

Create detailed characters

page 52

Artist info

Caleb Nefzen
(David Molina)

Personal portfolio site
www.invoke3d.com

Country Colombia

Software used ZBrush, Maya, UVLayout, KeyShot, Photoshop

This issue the awesome artist Caleb Nefzen showcases his ZBrush skills, carving character into his ninja sculpt. Elsewhere we consider 50 LightWave tips and tricks (p24), talk to the developers behind the industry's premier software (p34) and explore how 3D printing could one day save your life (p42).

Get inside the software Page 34

Welcome

to the magazine and 116 pages of amazing 3D

Hello and welcome to 3D Artist magazine! Animations and real-time games are all well and good, but sometimes nothing beats the brilliance of a well-sculpted still – check out Caleb Nefzen's work on p52 for evidence of that! Also, want to know how 3D printing could save your life one day (p42)? Curious about how software developers build the tools you're using (p34)? Or do you simply want to know how to model a cuttlefish (p80)? We have all that and more, so let's get going!

Chris Editor

Every issue you can count on...

1. **Exclusively commissioned art**
2. Behind-the-scenes guides to images and fantastic artwork
3. **A CD packed full of creative goodness**
4. Interviews with inspirational artists
5. **Tips for studying 3D or getting work in the industry**
6. The chance to see your art in the mag!

This issue's team of expert artists...

Caleb Nefzen

Whether it's horror movie icons or Viking-era Batman, Caleb aka David Molina is a total sculpting pro

Paul Pepera

With experience at Valve, 343 Industries and id Software, we just had to get Paul involved with the mag!

Drea Hovarth

Seasoned environment expert Drea delves into using Vue for animations, starting over on p68

Jahirul Amin

Jahirul returns with a new four-part Maya series. Be sure to check out the disc for the brilliant tutorial files!

Rainer Duda

This issue Rainer takes a look at Clarisse iFX, exploring how it can drastically speed up your workflow

Maximilian-Gordon Vogt

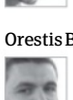
ZBrush expert Max gets up close and personal with an orc, revealing how to add detailed skin elements

Gleb Alexandrov

When it comes to creating beautiful Blender imagery, Gleb is your man. Turn to p88 to find out why

Sean Kalra

Vancouver Film School student Sean discusses how he used NUKE to integrate VFX elements into his showreel

Orestis Bastounis

Good work requires a good monitor. Tech expert Orestis takes a look at four of the best, kicking off on p94

Dave Scotland

Want to learn about The Foundry's latest release? Turn to p100. Fancy winning a license yourself? Turn to p18

Paul Hellard

Starting on p24, Paul gathers together some of the top LightWave minds in the business to offer their tips

Caroline Watson

Caroline sits down with MPC's global head of compositing, Doug Larmour, to discuss his approach to the craft

Sign up, share your art and chat to other artists at www.3dartistonline.com

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Contents 67

What's in the magazine and where

News reviews & features

8 The Gallery
A handpicked selection of incredible artwork to inspire you

16 Community news
Keep up to date with the latest news and happenings in the world of 3D

20 Readers' gallery
The 3DArtistOnline.com's community art showcase

22 Have your say
The best posts and artwork from our social media fanbase

24 Feature: 50 LightWave tips
Our top artists reveal how to get the most out of NewTek's tools

34 Feature: Inside the software
How are your favourite programs created? 3D Artist investigates...

42 Feature: How 3D printing will save your life
We take a look at how new medical innovations are changing the world

84 Subscribe today!
Save money and never miss an issue

94 Review: Monitors group test
Tech expert Orestis pits four top monitors against one another

98 Review: BEETHEFIRST printer
Could this be the world's first truly accessible 3D printer?

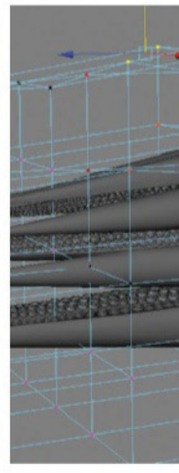
100 Review: The Foundry Production COLLECTIVE
We review the package that puts four top tools under one license

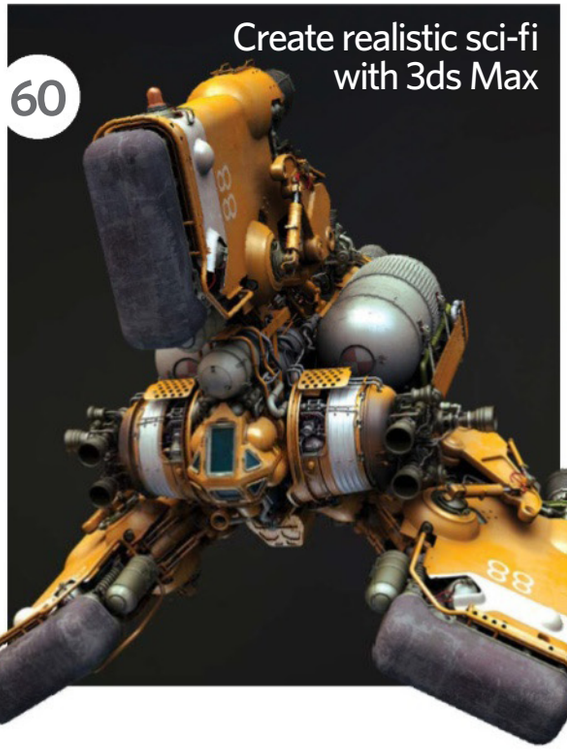
24

50 LightWave tips & tricks

"Add small imperfections. It adds realism when things are not aligned perfectly"

Jason Lee and others reveal their LW techniques **Page 24**





60

Create realistic sci-fi with 3ds Max

110

The Amazing Spider-Man 2

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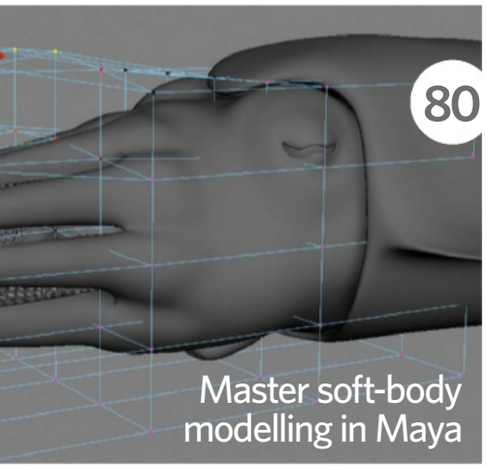
Turn to page 84 for details

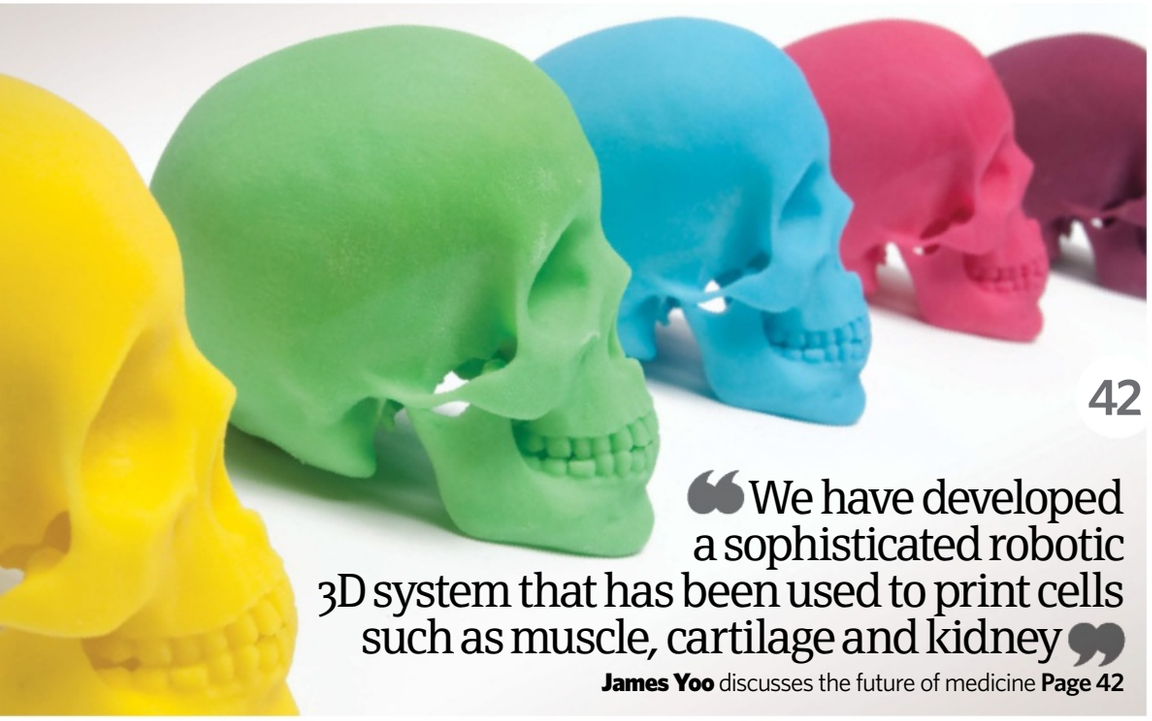


80

Master soft-body modelling in Maya

88

Grow grass with Blender



42

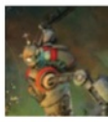
"We have developed a sophisticated robotic 3D system that has been used to print cells such as muscle, cartilage and kidney"

James Yoo discusses the future of medicine **Page 42**

The studio

Professional 3D advice, techniques and tutorials

50 I Made This: Irongore vs. The Invaders from Space
How Dennis Allain infused his work with a B-movie edge

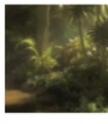


52 Step by step: Sharpen your ZBrush skills
Caleb Nefzen reveals the process behind this month's cover art

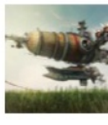
60 Step by step: Create a convincing sci-fi design
Game artist Paul Pepera on adding realism to fantasy

66 I Made This: Doorstep
Artist Ahmad Turki evokes memories of his past travels with this picturesque piece

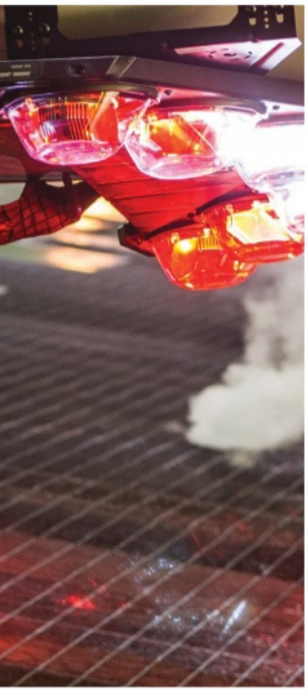
68 Step by step: Learn to animate in Vue
Vue expert Drea Hovarth talks us through Vue animation



75 I Made This: Journey Awaits
The *Final Fantasy* series and the emotions of departure inspired this piece by Tomi Väisänen



93 I Made This: Bullfrog
Matt Tkocz discusses implying functionality through design with this captivating mech



The workshop

Expert tuition to improve your skills

76 Masterclass: Build detailed structures with Clarisse iFX
How to build complex structures using simple methods

80 Back to basics: Model a cuttlefish in Maya
Explore soft-body modelling in this first of a new four-part series

86 Questions & Answers
This section is for users who have some experience of 3D and want to learn more

ZBrush: Skin surface techniques
Blender: Grow grass
NUKE: Set extension

workspace

Industry news, career advice & more

106 Industry news
Get up to speed with industry events

108 Industry insider: Doug Larmour
MPC's global head of compositing talks shop

110 Project Focus: The Amazing Spider-Man 2
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Turn to page 112 for the complete list of the disc's contents

WELCOME TO

THE GALLERY

Seven pages of great artwork from the 3D community

Ima

Artist info

Jirí Svetinský

3DArtist online

Username: Svjeeta

Personal portfolio site
http://svjeeta.deviantart.com

Country Czech Republic

Software used ZBrush, KeyShot and Photoshop

Work in progress...

"Be sure to head to **www.tinyurl.com/3DAhelpartsketch** to watch the amazing speed sculpt for this piece, largely carved out of one digital block of pixels!"

Chris Editor

Have an image you feel passionate about? Get your artwork featured in these pages

Create your gallery today at **www.3dartistonline.com**

Or get in touch... 3dartist@imagine-publishing.co.uk @3DArtist Facebook.com/3DArtistMagazine

"This piece started as a 2D sketch, which you can see at tinyurl.com/3DAhelpart. I decided to convert it to 3D using ZBrush. In this scene, the tribe members are hunting when they meet a troubled astronaut"

Jirí Svetinský, *Help*, 2014

Artist info

Stefan Morrell

3DArtist online

Username: Stefan-Morrell

Personal portfolio site
http://stefan-morrell.com

Country New Zealand

Software used
3ds Max and Photoshop

Work in progress...

"We never cease to be amazed by the imagination showcased in Stefan's work. This image goes to show how experimentation with form can result in something you never expected"

Chris Editor

"This image started out as a spaceship scene, but after messing with camera angles, I ended up with this massive building and street scene. I was influenced by Chris Foss with the bold colours and Neil Blevins with the heavy greeble use. This scene has no UV maps or textures and was heavily painted over in Photoshop, which made for a quick workflow"

Stefan Morrell, *City Block 09*, 2014

"The personality really shines through here. Even elements like the small dot for an eye communicate a sense of guilt and wrongdoing"
Larissa Staff Writer

Artist info

Lee Davies

3DArtist online

Username: Leemale

Personal portfolio site
http://armyoflee.tumblr.com

Country Ireland

Software used ZBrush, Maya, mental ray and Photoshop

Work in progress...

"This was created in about week, just for a bit of fun. I specialise in characters, but rarely get to work on anything non-humanoid, so this became an exercise in lending a character personality without relying on facial expression"
Lee Davies, *Caught Red Handed,* 2014

Artist info

Sengjoon Song

Sengjoon graduates from the Academy of Art University soon and is currently looking for work

Personal portfolio site www.sengjoon.com

Country USA

Software used Maya, MARI, UVLayout, V-Ray, Photoshop

Work in progress...

With design skills like this, we don't think it will be long before Sengjoon lands himself a job in the industry

Larissa Staff Writer

Design-wise, I wanted to maintain the woman's body silhouette, as I believe nothing else can be compared to its beauty. The model's face remained unknown until I met Pooneh from my modelling class. When I saw her, I knew that she was the Artemis!

Sengjoon Song, *Cybernetic Organism Artemis AA 3057,* 2014

"The character hidden inside the crystal adds a sense of narrative to this image, and the questions surrounding them and the environment really draw you in"
Chris Editor

Artist info

Michael Johnson

3DArtistonline
Username: Helioss

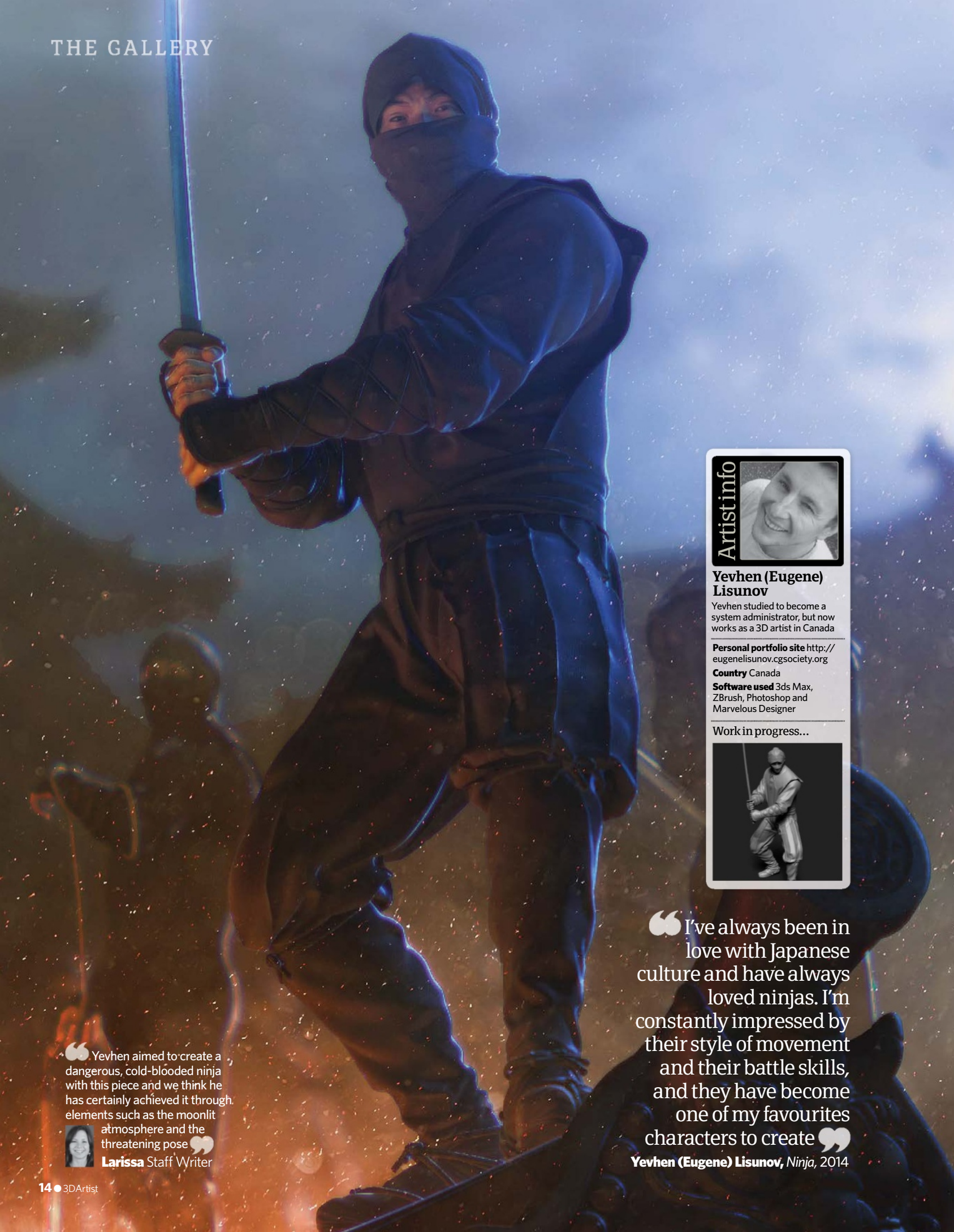
Personal portfolio site http://michaelljohnson.blogspot.com

Country USA

Software used 3ds Max, ZBrush, V-Ray, Fusion and After Effects

Work in progress...

"There are times at work when I'm not modelling any environments for a while, so I try to brush up and have fun at home. I think it's important to continue to learn new things and to have fun with what you do instead of feeling like it's a job"
Michael Johnson, *021114,* 2014



Artist info

Yevhen (Eugene) Lisunov

Yevhen studied to become a system administrator, but now works as a 3D artist in Canada

Personal portfolio site http://eugenelisunov.cgsociety.org

Country Canada

Software used 3ds Max, ZBrush, Photoshop and Marvelous Designer

Work in progress...

"I've always been in love with Japanese culture and have always loved ninjas. I'm constantly impressed by their style of movement and their battle skills, and they have become one of my favourites characters to create"

Yevhen (Eugene) Lisunov, *Ninja*, 2014

"Yevhen aimed to create a dangerous, cold-blooded ninja with this piece and we think he has certainly achieved it through elements such as the moonlit atmosphere and the threatening pose"

Larissa Staff Writer

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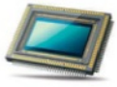

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Hunt advises applicants to prioritise the quality of a demo reel over quantity. Showcasing talent in one discipline, he says, is what students will usually get judged on Image: Stefan Schneider

CG Student Awards 2014

We talk to Alwyn Hunt, co-founder of the CG Student Awards, about the event's history and the exciting prizes and prospects for 2014 and beyond

What first inspired you to create the CG Student Awards?
It started five years ago when the other co-founder Andrew McDonald and I were both based in London running the CG Coach side of things. We saw an opportunity for a student award because there were no other awards like that at the time. We wanted to be able to showcase the excellent work students are doing all the time. People are shocked when they see just how good student work can actually be – even we're amazed each year with the quality coming through. It's great to see and that's what the awards are all about – just showcasing the different talents from around the world and bringing it onto that global stage via the website, www.cgstudentawards.com.

Was it challenging organising those first awards? How did you go about creating such an event?
Between Andrew and myself, we've been in the industry for 15 to 20 years and it was only through contacts at the big post-production studios that we worked at. We approached them and asked if they would be interested in offering an internship if we could organise some really good students out of these student awards and, fortunately for us, they were responsive. That was the draw-card for enticing artists in – once we had internships, we started contacting the big hardware and software sponsors and we pieced those two together and managed to build a website. Being able to recognise the fact that there was a lot of talent out there was one thing, but we had to sell that idea back to the studios and how for them it was an opportunity to filter entry-level students to get good interns too.

Now that the awards have grown so successful, has a lot changed about your approach to them?
Not really, to be honest – it's grown, but we've refined it and gotten more sponsors on board. This year is going to be a massive year for us because we've expanded into next-gen

"Autodesk is the naming rights sponsor, which is massive for us," says Hunt. "It's come on board and is supporting what we're doing and how it's encouraging students." Image: Hakju Lee

Making the awards live

Andrew McDonald reveals what's planned for the future of the CG Student Awards

"Another thing we are trying to do in the long term, apart from getting the online element of the awards growing, is to organise a live event," reveals McDonald. He emphasises that this wouldn't be a simple awards night, but more of a live networking event with the students' work showcased all over the walls, so that industry insiders could get to know the winners offline. "For a lot of sponsors too, face-to-face seems like a much better option," he adds. Both co-founders hope to organise the event to coincide with another global gathering, such as SIGGRAPH or FMX, to increase its exposure.

gaming from the original awards, which were more focused on visual effects. A huge gaming studio that we've managed to get on-board this year has been Crytek. It's not offering a traditional internship either – it's a more extensive internship for six months, it's paid for and there's a lot of perks to go with that salary. The other big novelty for us this year is the Young Guns category. High school students are also doing amazing work and no one's showcasing it at the moment, so we're hoping to get them on board as well with this new category.

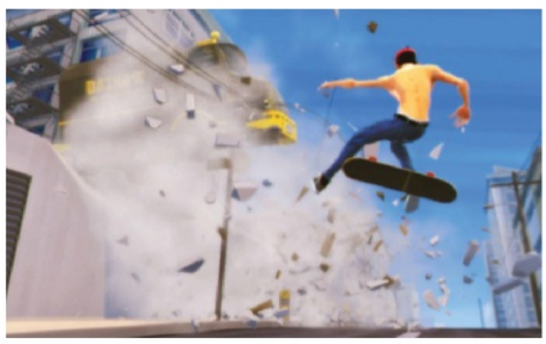
Aside from that, we have around 30 sponsors and this year I think we have 15 internships being offered by studios from all around the world, including Weta Digital, Double Negative, Epic Games and Framestore – all the top studios. Pretty much anyone that's anyone has jumped on board for this year. We're also at over $230,000 worth of prizes at the moment, so it's gone from strength to strength and there's $100,000 for School Of The Year too.

This is a big push for us because we want to try and develop a healthy competition between schools to be number one. We see some schools out there that really showcase the student's work, but rankings are usually just dictated by statistics from certain people. It's overwhelming when you're somebody that wants to learn and there's so many training facilities that you're being told about. We just want to say 'hey, here's a student award that can actually prove that your students are the best', and create a school ranking system that students can go to that's been voted on by industry professionals.

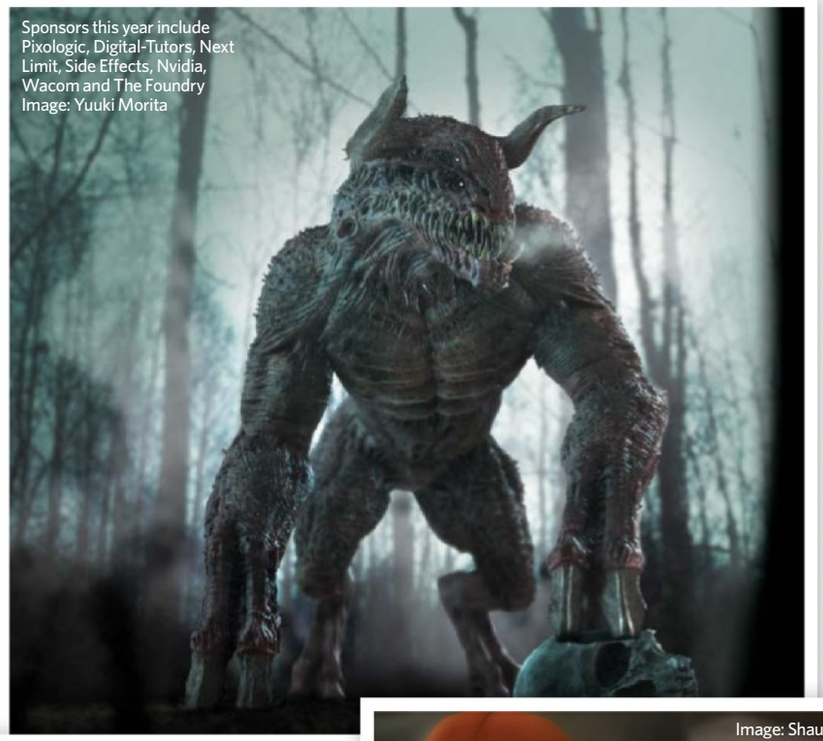
What benefits would students who apply gain from the process? Why should they apply?

There's that $230,000 worth of prizes, so it's a great opportunity for students to win stuff, even if they're not big winners. Something to also bear in mind is that a lot of industry insiders are looking at the demo reels on the website now, so even if students don't win, there's a good chance that the industry is still looking. It's a good stage for students and a great way to be able to compare themselves with their peers to see what level they're at and how much further they need to go to be able to compete for internships. We encourage everybody to upload their demo reel, even if they don't feel like they'll win, just to get their work exposed and seen by other people.

We're really excited about launching – we've got a brand new website, which we've rebuilt as a very visual site. It highlights past winners, it's got a hall of fame of really excellent work from previous years and we think it's going to be really successful.



Brilliantly, you'll win prizes for just entering the CG Student Awards 2014! These prizes include one month of access to Digital Tutors and copies of 3DTotal's 2D and 3D magazines. Image: Luca Xavier



Sponsors this year include Pixologic, Digital-Tutors, Next Limit, Side Effects, Nvidia, Wacom and The Foundry
Image: Yuuki Morita

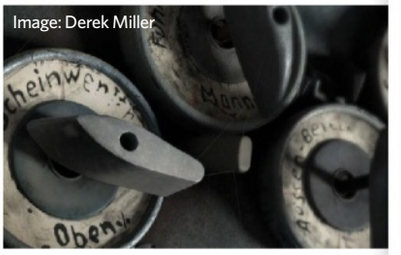


Image: Derek Miller

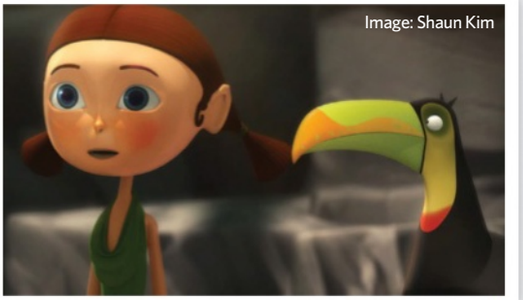


Image: Shaun Kim

> "We encourage everybody to upload their demo reel, even if they don't feel like they'll win, just to get their work seen by others"
>
> **Alwyn Hunt** Co-founder of the CG Student Awards

Image: Chris Debski

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With the Production COLLECTIVE you can go from 3D modelling through to final shot management all in one go, thanks to a package that includes NUKEX, MODO, MARI and HIERO.

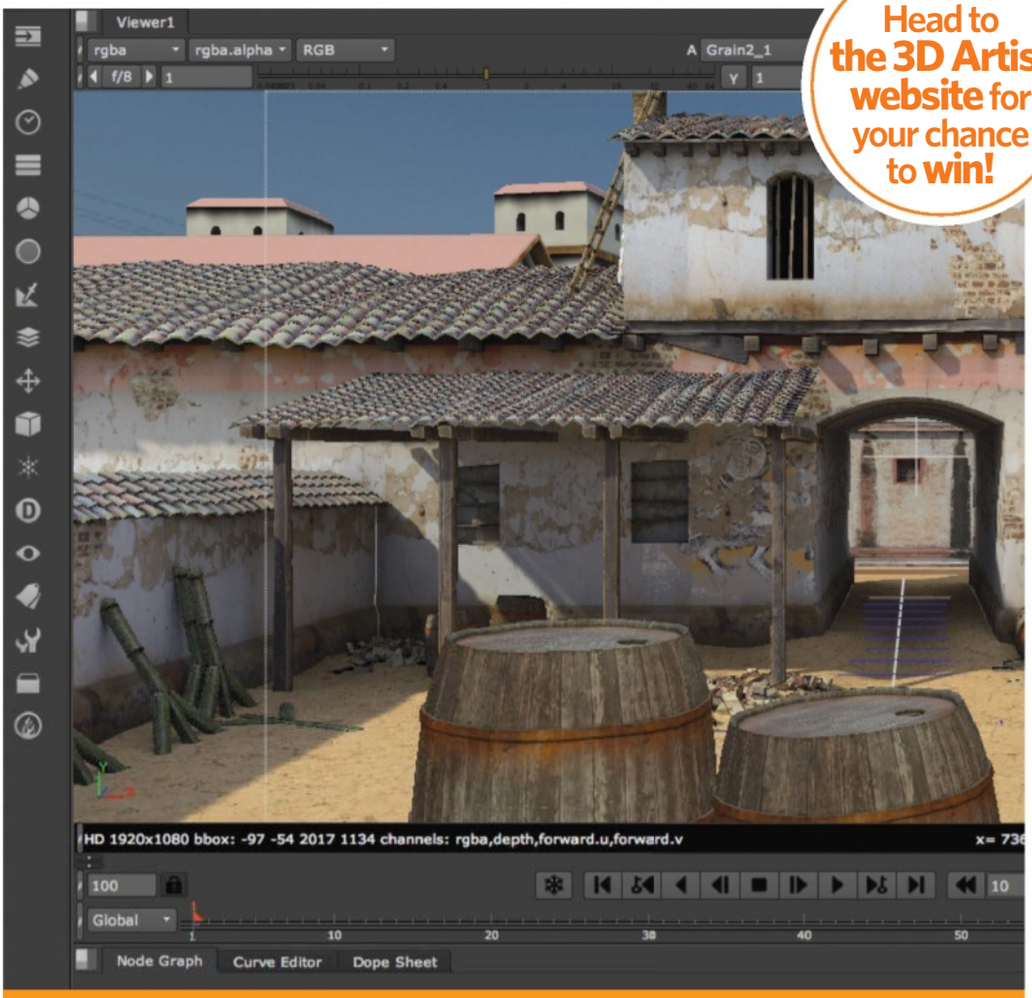
If you want to get your hands on this bumper 3D compilation, all you need to do is head to our website at www.3dartistonline.com and answer the following question:

Where is the name NUKE derived from?

a) Nuclear compositing
b) New compositor
c) Chroma key compositing

Entry for the competition closes on 20 May 2014.

Head to the 3D Artist website for your chance to win!



The Production COLLECTIVE: NUKEX, MODO, MARI, HIERO (£6,000)

PRODUCTION COLLECTIVE.

About The Production COLLECTIVE

The Production COLLECTIVE toolsets enable digital 3D modelling, animation, paint, effects, playback, editorial and shot management in a single license. With a COLLECTIVE license, one user at a time has the ability to run any of the products in the Production COLLECTIVE. These include the award-wining node-based compositor NUKEX, the end-to-end CG solution MODO, the cutting-edge 3D paint tool MARI and the all-in-one shot management, conform, edit and review software HIERO.

About The Foundry

The Foundry is a global developer of computer graphics, visual effects and 3D design software for the design, visualisation and entertainment industries. The workflows created by the company serve multiple industries, making the creation process a walk in the park. The Foundry's portfolio is as creative as it is technical, packed full of ground-breaking and award-winning tech that will have even the most demanding organisation or one-man show salivating. **www.thefoundry.co.uk**

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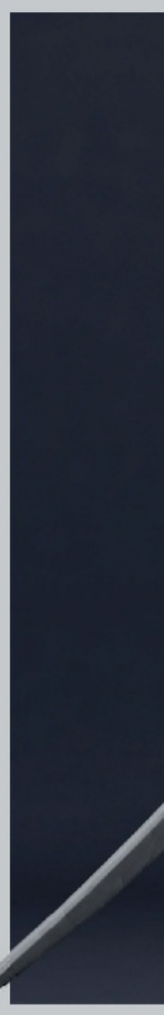


Images of the month

These are the illustrations that have been awarded 'Image of the week' on 3DArtistOnline.com in the last month

Share your art
Register with us today at
3DArtist online .com
www.3dartistonline.com
to view the art and chat to the artists

A The Hunter
» **Angel Alonso**
3DA username Angelitoon
Angel says: "For this image I used Vue to create the volcano and the background, and I added the fire and smoke using FumeFX. The characters were created using ZBrush and 3ds Max."
We say: *If this were a videogame, we'd probably want to play it. Any image that imparts a sense of narrative is a winner for us, and this one certainly does so – what strange planet are these two characters on, and what is it that brought this unlikely pair together?*

B Crowd Control Unit
» **Tomi Väisänen**
3DA username Tomivaisanen
Tomi says: "This is a piece of hard-surface armour design. It was modelled with 3ds Max and rendered in V-Ray, with compositing and adjustments performed in Photoshop."
We say: *Some very nice hard surface modelling work here. The design is instantly attention-grabbing, but what makes it really stand out is how Tomi has approached the materials and reflections of the piece. It really does evoke a sense of authority and intimidation.*

C Centaur
» **Michael Milano**
3DA username Milano
Michael says: "This is a centaur that I sculpted in ZBrush. You can view a 360 degree view of the model and several renders at **www.cgmodeling.com/centaur**"
We say: *The anatomical elements of both the human and horse in this image are just perfect, but what's really impressive is just how Michael has brought them together, imagining the muscles that would hold the human torso onto such powerful legs.*

D Cockaturtle
» **David Macias**
3DA username DavidMacias3d
David says: "I am taking a special topics class for ZBrush at the moment and I chose to model Bobby Chiu's Cockaturtle in 3D form."
We say: *In a medium that is often overcrowded with sci-fi, fantasy and violent-looking characters, it's nice every once in a while to look at something that little friendlier and more adorable. What a nice little character – where can we get one as a pet?*

Image of the month

Cerberus
» **Aamir**
3DA username aamir
Aamir says: "This was a personal work created using ZBrush and Photoshop. The concept was based on a work by Devon Cady-Lee"
We say: *We don't really have to explain why this image is so striking – you just need to look at it to know why! The creature simply leaps off the page, and is also imbued with a great sense of character. Here boy!*

Carlos
» **Farkas Zsolt**
3DA username ekho
Farkas says: "Meet Carlos (named by my wife). I saw him on an old paper photo a few years ago and decided that I had to make it in 3D. His look, one of sadness and pride, captured my imagination instantly."
We say: *Nice use of colour in the hat here – it really draws your eyes to the image, before slowly moving down across the weathered face and buckles and trinkets that adorn the character.*

Ocean City 5
» **Angel Nieves**
3DA username vertexangel
Angel says: "The main ship in this image was inspired by a ship described in the novel *Leviathan Wakes*. I started the model in LightWave then moved to Maya and added details. The environment was created in ZBrush."
We say: *There's something just so cool about giant spaceships in atmosphere, launching from city-sized docking bays. This image is given a great sense of scale by the tiny character in the foreground.*

Agent Masha
» **Marlon R. Nunez**
3DA username enishi
Marlon says: "The idea was to blend cyberpunk style with reality. The model is based on my Russian girlfriend. I like to mix a bit of everything in my art!"
We say: *We really like the robotic arm here, and the manner in which the mechanical features still communicate a sense of the female form. We can't help but feel sorry for the character, though – surely she must be cold in those shorts!*

Have your say

Email, Tweet or get in touch with us on Facebook to share your thoughts, opinions and proudest projects

Top tweets

Get involved... @3DArtist

@JForthDesigns Just resubscribed to the magazine. Are you guys going to be having any more Blender features?

3D Artist We're definitely going to have more Blender features, along with more tutorials! Thanks so much for subscribing again!

3D Artist *The Incredibles 2* is now officially in development!

@mattmario89 YES!

@CedricLetort Very cool!

@sailor_stewie84 Look what I had waiting for me on return from ops overseas! Busy Sunday ahead!

On the Wall

Facebook.com/3DArtistMagazine

Facebook has bought Oculus VF for $2 billion. What do you think? Bad move?

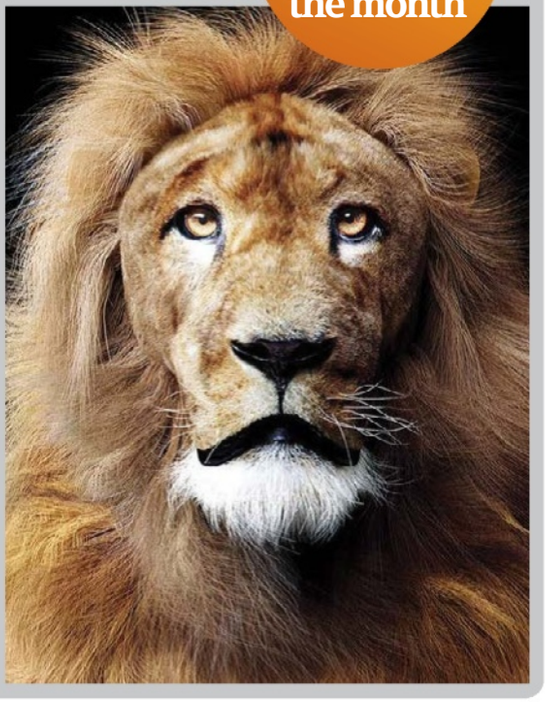
Matthew Schmidt Probably great for all those out there who prefer socialising in a non-real world environment. Me, I like my social life in real life and my VR world to be kept as unsocial as possible.

Steamed Bryan Bun They bought this company so they want to improve it with Facebook's powerful financial resources. In this case Facebook is like a good agent to the potential star.

If you want to have your work or thoughts displayed here, get in touch with us via email at **3dartist@imagine-publishing.co.uk**, via Facebook at **facebook.com/3DArtistMagazine** or on Twitter **@3DArtist**

Social media images of the month

Tiny Sheep
» **Pota Tseng**
We say: "This cute, fluffy little sheep couldn't contrast more with the proud lion to the right, but that's why we like it! Colourful, floaty and light, there's a great deal to love here."



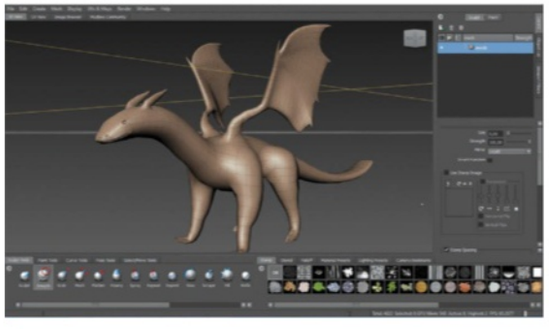
Lion
» **Gustavo Garibaldi**
We say: "This is bringing back some really happy memories of our cover image for issue 61. Some fantastic work here, especially on the differentiation between short hairs, longer hairs and whiskers."

Imagine Dragons

Hello! I'm an aspiring 3D artist and this is the dragon I am making. It's a work in progress, intended for games mods like *Dota 2* and *Skyrim*. What do you think?

Xerat Dragons, via Facebook

This is a really great start for a beginner – the general proportions and form are all there and the wings are already looking very reptilian. Now it's time to work on the body and legs, then start adding some detail to this beast!



YOUR TOP WALL POSTS

I Am Not A Robot
» **Eliane Ck**
We say: "There's something simultaneously engrossing and disquieting about this image – who is this half-naked, feral cyborg and how did she end up in this strange and sinister situation?"

Polysketch – Gauna
» **Marcello Baldari**
We say: "If you're a fan of Marcello's polysketch technique then be sure to pick up issue 57, where he discusses the technique in depth! http://tinyurl.com/3DAissue57"

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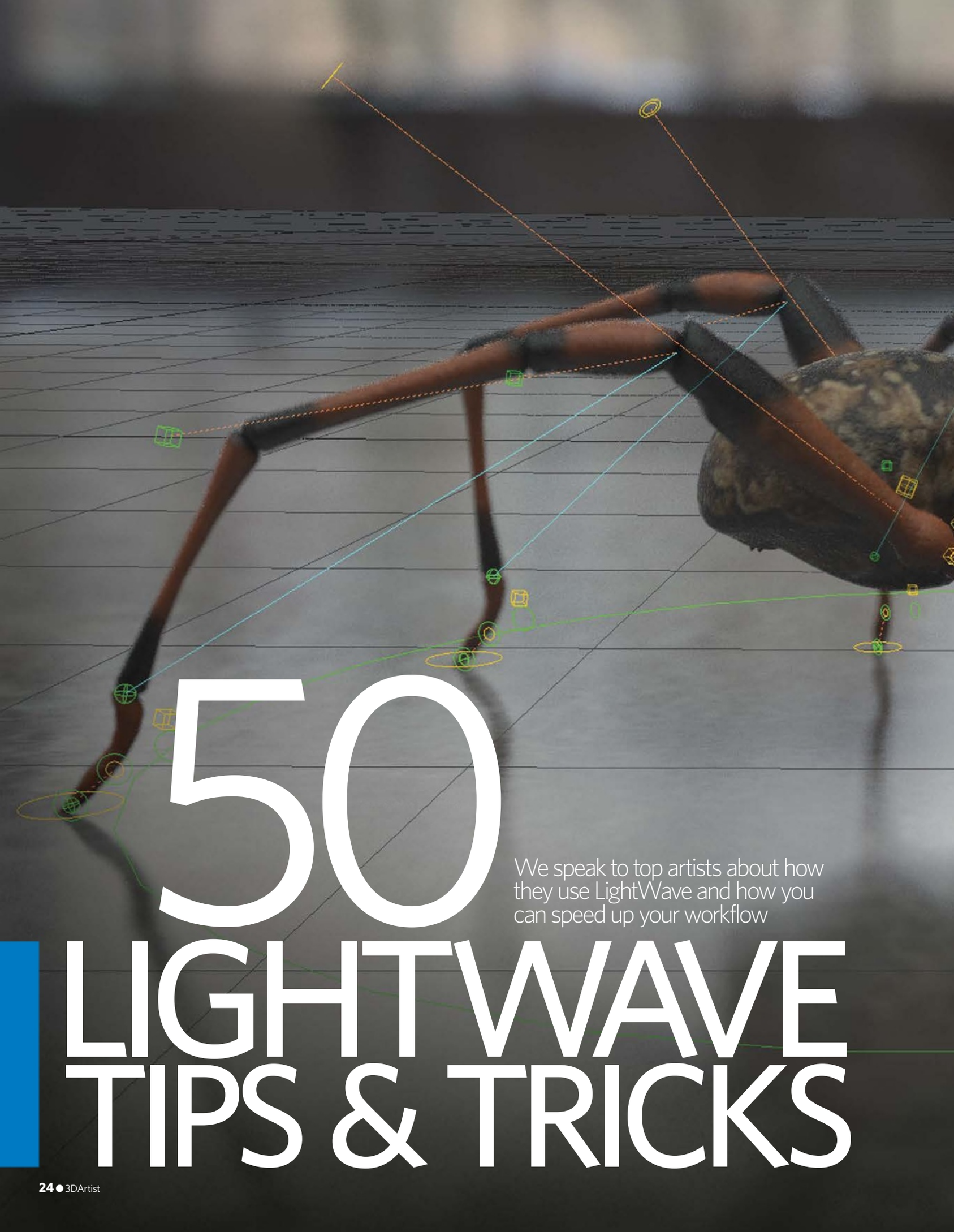


50 LIGHTWAVE TIPS & TRICKS

We speak to top artists about how they use LightWave and how you can speed up your workflow

DAVID AGUERO
Freelance 3D generalist
Buenos Aires, ARGENTINA

CODY BURKE
LightWave 3D Group
Texas, USA

BEN COOPER
Dreamvision Company
Florida, USA

LOUIS DU MONT
We Are Formation Ltd
London, UK

SAHIN MICHAEL DERUN
Animaj Film and Animation
Istanbul, TURKEY

LINO GRANDI
LightWave3D Group
Rome, ITALY

JASON LEE
Art director, Sullivan Branding
Tennessee, USA

STEVE MCARDLE
Designer and animator
Ontario, CANADA

BRETT MURRAH
Lead animator, XVIVO Scientific Animation, Connecticut, USA

WILLIAM VAUGHAN
Academic director, The DAVE School, Florida, USA

LightWave has a long and illustrious history in the computer graphics world. It all began in 1988, when NewTek planned to incorporate animation and modelling programs Videoscape and Modeler into its video-editing suite, Video Toaster. What was once to be called the NewTek 3D Animation System for the Amiga soon became LightWave 3D, and one of the industry's first end-to-end production pipelines was born.

In the 26 years since, NewTek's software has grown in leaps and bounds, becoming a hugely popular tool in everything from advertising to visual effects, motion graphics, arch-vis, music videos and much more. LightWave 11.6 brings with it some very special new features and enhancements. There's now a new Spline Control that helps to control the movement of snakes, trains or anything that requires a natural fluid movement in animations. Also, Python scripting in LightWave 11.6 has been enhanced to enable artists to do far more with it, and there's been a boost in the speed of VPR Interaction within Layout.

We invited some of the LightWave's best-of-class to discuss a selection of the tools they love in the latest NewTek offering. Read on for tips and tricks in modelling, materials and texturing, as well as animation, lighting and rendering. So go on and open up LightWave to give these tips a try!

Background HDRI image by Chris Huf | **www.hdrlabs.com**

50 LightWave tips & tricks

MODELLING

01 Subpatch modelling For subpatch modelling I like to move points around after the model is complete to add small imperfections. It adds a lot of realism when things are not aligned perfectly. **Jason Lee**

02 Be realistic Always try to model your objects to a real-world scale. It makes it easier when you are texturing and if you are using depth of field it will calculate correctly. It also adds to the general composition of your work. **Jason Lee**

03 Randomisation If you need a lot of random objects, like an asteroid field for example, use the Spray Points tool to create a field of points. Then, if you want to clone your object into the foreground layer into the points in the background, use the Point Clone Plus tool. **Jason Lee**

04 Round things off Be sure to round your edges, especially for close-ups. Nothing in the real world has perfectly sharp edges. The Rounder tool works well for this. **Jason Lee**

05 Edit Geometry in Layout This is particularly handy for front projection techniques. Creating rough geometry for projecting imagery from the Camera can be tricky to do with LightWave, as you can't tweak the geometry from the Camera's field of view within the Modeler. You can, however, tweak vertices in Layout by using SoftFX. You can add SoftFX from the FX tab in Object Properties. Calculating a small number of frames, you can now drag the vertices around by clicking the Edit Tool button under the EditFX tab. Using a higher Edit Size value enables soft selection, similar to the Magnet and Drag Net tool in Modeler. You can then save it out as a Trans Object or Endomorph via the Save menu. **Louis du Mont**

06 Add multiple edges quickly in Modeler Using the Connect tool can drastically speed up your workflow by enabling you to add and remove edges from your model faster than ever before. Select a loop of polygons by selecting two connecting ones and tapping the right arrow-key. You can also move the selection up or down by using the up and down arrow-keys. Then simply tap the L button multiple times to quickly add edges into your selection. **Cody Burke**

07 High-poly modelling One of the things that I see most of all with work sent to me or when I collaborate is incorrect poly-flow and line work. When closing off circular forms to reduce polycount in Sub-D modelling, utilise triangles to help break down three polys to two, so your mesh is cleaner and more efficient. The time you do not want to use triangles is when you are meshing broader curved surfaces or edges. Triangles will pinch in Sub-D modelling and cause smooth areas to buckle. When moving across flatter areas defining shapes, triangles will enable you to solve poly-flow problems that a quad-only approach will have you doing mental gymnastics to complete. It's all about efficiency and finding the most direct means to an end. **Steve McArdle**

08 Sub-D modelling The trick I use when Sub-D modelling is hitting the Tab button to put my model into Sub-D viewing mode, and then using the Tweak tool that shows you an overlay of the non-Sub-D mesh as well. You get to see your model in both modes at the same time for editing, which saves you having to flip back and forth, eating up an undo counter each time you do it. **Steve McArdle**

9 Store Selected Objects This is a very good tip to speed up your workflow when quickly setting up a scene. The new Assignments category is under the Setup tab in Layout and towards the bottom left of the interface. You can now select any object and Store Selected then do the same for any other. When two items are stored you can then twirl down the Assign menu and target the items together, parent, pole, set goal items and a variety of other options. **Cody Burke**

10 Flip normals Upon importing an object that has been modelled in another package, you may find that the normals of the object might be flipped the wrong way. Simply hit the F key to flip them around the other way. This method can also be applied on a per-poly basis, if you have the polys selected that you want to fix. **Ben Cooper**

11 Transform instances into meshes The instances system in LightWave 3D is extremely powerful. Using it makes it easy to distribute lots of objects quickly and precisely. In any moment we can convert all the instances into real meshes. That way we can immediately apply dynamics or animate a particular object individually. If we want to convert the instances into meshes, all we have to do is select the instanced object and use the Python script named bake_instance.py, which is located in NewTek>LightWave11.7>Support>Plugins>Scripts>Python>Layout>Generic. **Lino Grandi**

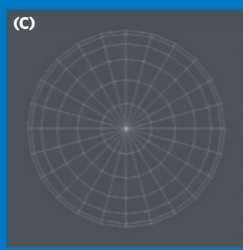
12 The Tweak tool One of the more recent modelling tools that I've really started to rely on is the Tweak tool. It enables me to manipulate points, lines and polys all in the same tool without having to switch between modes. It is incredibly fast and versatile, but the biggest strength of this function is that if you hold down Shift while you're using it, it constrains your movement to the normal of the point, line or poly. **Steve McArdle**

13 Merge multiple UVs
Ben Cooper

In some situations, such as if you're working on an environment with objects that might not get close to camera, you may want to merge multiple object UVs into one set. However, some objects may be easier to handle when UV'd separately, so that afterwards you can merge the created UVs of all the individual objects into one set.

Here, we have a simple cube and sphere. **(A)** Both of these have a UV of its own and each object is on its own separate layer. **(B,C)** Now press f8 to bring up our Maps menu. Under the Texture widget, we will see two UV Maps, one called Cube_UV and the other called Sphere_UV. **(D)** To merge these two into one, right-click on Sphere_UV, select Copy and type in Cube_UV, which acts as the destination for our Sphere UV – it's more of a Copy To command. Then, with both object layers selected, you will see both UVs showing up in the UV Texture editor on the Cube_UV. **(E)**

(C)

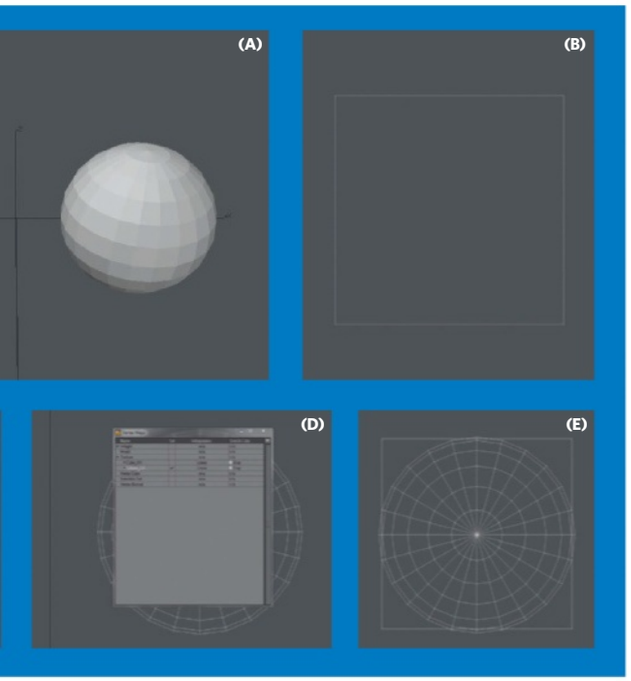


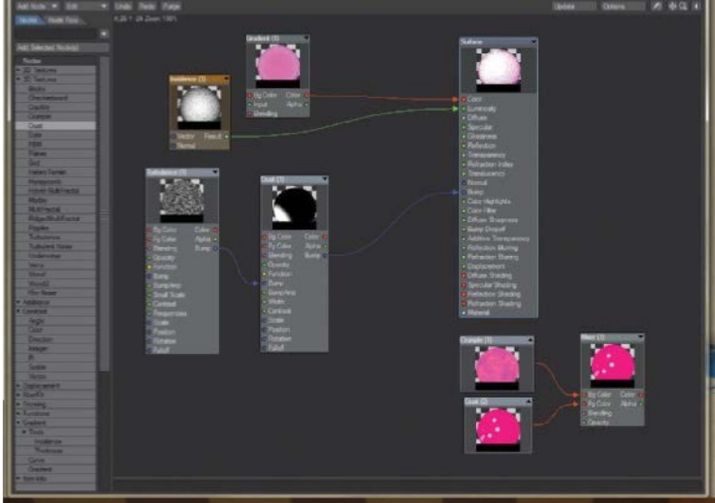
MATERIALS & TEXTURING

14 Camera mapping UVs in Modeler The Texture Guide tool in Modeler enables you to interactively create a UV map for selected polygons. By setting the Mapping mode to Camera you'll see a dotted pyramid representing the attributes of a real camera that you can actually use to create a UV from any angle you want. The point of the pyramid can be thought of as the lens and the flat base of the pyramid can be thought of as the picture that will be used for the map. This tool is found under Map>UV/Texture>More>Texture Guide. Once it's enabled, hit the N key to bring up the numeric options and change the Mapping mode to Camera. Make sure one of your views is set to a UV Texture grid and in the numeric panel enable Make UVs. You will immediately see your map appear in the texture space and as you continue to adjust the camera, your map will interactively adjust. **Cody Burke**

15 UV Border Edge When baking in rendered details to a UV map, the UV Border tool comes in very handy in helping to avoid unsightly seams that can occur along the edges of your Unwrapped geometry by growing the edges of the baked-in pixels. If you own a later version of Photoshop, Content Aware Fill can be used to close up the blank areas of a baked in texture to eliminate the possibility of seams. **Louis du Mont**

16 Include Reference objects One of the most efficient ways of interactively placing textures is with the use of Reference objects. Add a Null to your scene and select it from the Reference object dropdown list, and the Scale, Position and Rotation of that Null will drive the values of any given texture. This option is available throughout LightWave and can be found in both the Texture editor and Node Editor. Once added to your workflow you'll wonder how you ever got by without it. **William Vaughan**





Tip 18

17 Fake rim lighting with texturing

Sometimes it's just quicker to fake it. I quite often pull this little trick out when in need of some quick rim lighting. Using a Gradient with the Input Parameter set to Incidence Angle for the Color Channel on a given surface enables me to quickly achieve the appearance that my mesh is being lit from behind. Adjusting the keys along the Gradient gives me full control on deciding just how soft the lighting will appear across the surface. This technique also lets me easily control what surfaces are affected. By using this method, I have the ultimate control over the scene. **William Vaughan**

18 Store unused nodes

One of the best features of the Node Editor is the ability to store unused nodes within it. When texturing, I like to explore a variety of Node flows until I find a setup that delivers the exact look that I'm after. I may try half a dozen to a dozen different setups, but I never remove any of them from the editor – I simply move them out of the way so that I can easily come back to that flow at any time. Anytime I come back to that surface, all the unused flows are still stored within, which means that I don't have to re-create it. So, the next time you are about to delete unused nodes from your workstation, remember that they may come in handy at a later date and you might be better off simply moving them aside for possible future use. **William Vaughan**

19 Vertex Color maps

Vertex Color maps are easily overlooked and often forgotten. These powerful maps enable you to store RGBA values to each vertex and can be the easiest way to add eyeshadow to a female character, stubble to male

50 LightWave tips & tricks

characters and an endless variety of details to any mesh. When Vertex Color map values are applied with the Airbrush tool, colour can be added with beautiful falloff that can match the quality of a Color map generated in a paint package without the hassle of jumping into another program. One of my favourite attributes of Vertex Color maps is that the colour data is stored in the vertices so there are no external image files needed. All of the data is stored in the mesh itself, so there is no need to create UV maps, images and so on. **William Vaughan**

20 Use Weight maps for texturing

Although most artists think of rigging when Weight maps are mentioned, I first think of texturing. They are my go-to solution when I need to isolate an area when applying a texture. They are so simple to generate and apply to a surface that I'm always surprised to discover how little they are used by other artists for texturing. To use, simply create a Weight map in Modeler and give the selected vertices a value. In the Node Editor or Texture Editor, create a Gradient and set its Input Parameter to Weight Map and select the Weight map you created to drive the values of the Gradient. You can bypass the Gradient when using the Node Editor and plug the Weight map directly into the Opacity of any given node, although I always recommend using a Gradient as it can enable further refinement of the Weight values without having to return to Modeler to make additional adjustments. **William Vaughan**

21 Create better transparent and reflective surfaces

If you study reflective or transparent surfaces on real-world objects, you'll notice that their values vary over the shape of the object. Looking at the surface of a car, for instance, the reflections become crisper towards the edges of the vehicle. A clear drinking glass appears to be more transparent in the centre when compared to the outer edges. Although LightWave ships with some amazing materials that mimic these real-world attributes, I find I have more control if I create my surface from scratch. The key to getting good reflective or transparent surfaces is the use of Gradients with an Input Parameter of Incidence Angle. Using Incidence Angle to drive a Gradient enables you to adjust the values at the edges of your mesh. For a realistic reflective surface, increase the value for the outer edges and for a realistic transparent surface, decrease the value along the outer edges of the mesh, which in turn would make the outer edges less transparent. Adding that level of control to your surface attributes will enable you to attain a higher quality surface. **William Vaughan**

22 Implement the Spot Info node: Polygon Side

There are many times that I need to create different surface attributes for each side of a double-sided surface, but prefer to not duplicate the geometry in order to do so. LightWave 9.0 solved the issue with the inclusion of the Polygon Side option found in the Spot Info node within the Node editor. Using this feature, it is possible to apply different Image maps to each side of a double-sided polygon in the Color Channel to create a different surface to each side of a piece of paper, for example. Simply plug one Image map into the BG Color, another into the FG Color then and drive the Opacity of a Mixer node with the Polygon Side output of a Spot Info node. This will give you a double-sided surface with different images on each side. This setup has simply so many uses that it should be a must-have in your toolkit. **William Vaughan**

23 Use procedurals to blend images

I've always been a massive fan of manipulating surface attributes with procedural textures and one of my favourite uses of these textures is to blend multiple image maps together. By using procedural textures to do this, it is possible to achieve a more random pattern than if attempting to do it manually in a paint program. Also, by using procedurals to composite the images together we can explore a variety of procedural patterns until finally achieving the desired look. To add this technique to your texturing workflow, simply feed different Image maps into a Procedural node's BG and FG Color Input channels and adjust the Procedural attributes. You will quickly discover that there are endless possibilities. **William Vaughan**

24 Exclude lights from surface

The Bi-directional Reflectance Distribution Function (BRDF) shader is a powerful option that is often overlooked, which has the amazing ability to exclude specific lights from a given surface. Add this shader to any surface by clicking on the Add Shader button found under the Shaders tab in the Surface editor and selecting BRDF Shader. Uncheck any light in the Lights list to exclude that particular light from the surface and you'll be in full control of lighting that specific area. **William Vaughan**

25 Use Cubic mapping

Do not underestimate the power of Cubic mapping. This often-overlooked mapping option can save massive amounts of time and produce amazing results. It can be the fastest way to map complex geometry and it can save you hours of UV map creation and custom image maps. I have used it on everything from environments to space ships and characters and it has replaced my use of Spherical mapping in most cases as it eliminates the issues of distortion. **William Vaughan**

26 Make a Procedural Terrain

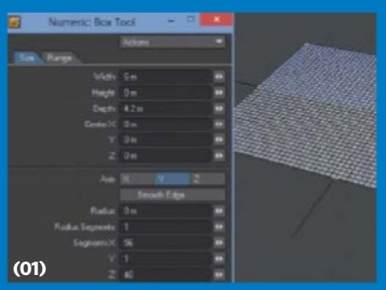
David Aguero

After opening Modeler, go to the Create tab and make a plane with the Box tool **(01)**, then apply a Sub-D with the tab button.

Press Q to assign a new material, then rename it to Stone. Copy that plane and paste it into another layer. Assign a new material and call it Dirt, then save the object and send it to Layout.

Now there are two objects in the scene. Select the first plane and go to Properties by hitting P. In the geometry tab, increase the Displace Subpatch level to 6 and the Render to 10. Then go to the Deform tab, locate the Displacement Map button (T) and add two procedural layers. For the first layer choose Turbulence and for the second layer select Crumple and change the Blending mode to Additive **(02, 03)**. With these settings, your terrain will look quite harsh and unrefined **(04)**.

Copy the same Displacement to the other plane, but with a lower Subpatch level. The default values will be fine at 3, but for this plane we are going to lower the Procedural texture values a little, then move the object in the Y axis to find the suitable amount of Dirt **(05)**.



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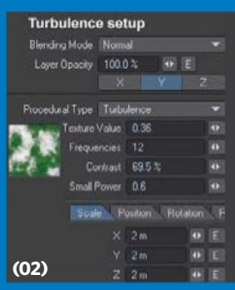
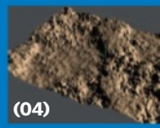


(02)

After applying textures and tweaking the materials, it's time to use a technique to blend the Dirt layer so that the cut between geometries isn't so obvious. This is also helpful in hiding the low subdivision geometry.

To achieve this effect, **(06)** open up the Material editor and select the Dirt material, then go to Transparency texture and add a Gradient. In the Input Parameter select Surface Thickness. This option will give you a Gradient that is calculated from the intersection of the geometry to a distance of your choice. **(07)** The result will display a nice blend between materials. To finish off this surface material, add a few small rocks.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ANIMATION

27 Animate vehicles along a path

Earlier versions of LightWave required complex setups for moving objects along controlled paths over time, especially if you had to deform the object along that path. In LightWave 11.6 it introduced Spline Control in Layout, which enables much easier control. One of the things that I've found a great use for it is creating motion paths for vehicles. Previously, if you were changing the banking of a vehicle as it drove over a winding road it was a case of trial and error because you had no visual feedback of how the motion path banked. The Spline Control creates a visual ribbon on the screen that enables you to see all the motion characteristics from start to finish. The trick when setting this up is to make sure the Spline Control sits at the bottom-most Y value of the wheels so that the vehicle is literally driving on the spline. If you want to get clever, you can actually create the road to be deformed by the same Spline Control path, so that your tires are locked to it. Doing them separately gives you additional control, however, to have your vehicle deviate from the precision of the ground beneath it. **Steve McArdle**

28 Spline Control hierarchy

Spline Control requires the controls defining the curve to be parented to the main Spline Control Item. In some particular setups we may need to parent the controls to other items in the scene. In that case, the best solution is to use Same As Item on the required channels, in World Coordinates mode. That will make it possible for the controls to follow the motion of the selected Same As Item control item, while keeping the Spline Control hierarchy intact and operational. **Lino Grandi**

29 Apply Cyclist additive options

Using Cyclist (Motion Panel>Add Modifier) makes it possible to link a complex animation to an item motion. It's a very powerful Set Driven Key. Negative frames can be used to define the animations. Previously it was possible to apply just one Cyclist motion plug-in to any item, limiting its power, but to solve that an Additive option has been included. This means we can now apply multiple instances of Cyclist and have them affect the item motion at once, enabling more complex rigs. **Lino Grandi**

30 Proximity Modifier for DOF targets

Achieving accurate depth of field on a still camera is a simple task, but some may not know that it is just as easy to do so on an animated camera as well. In order to do this we are going to add a modifier known as Proximity to the Focal Distance envelope of the camera. Next, add a Null and name it DOF_Target. Open up the Proximity properties and you'll notice a dropdown menu to choose the Target. Select your DOF Target and now whenever you move that Null, the camera's focal distance will automatically adjust to stay in focus. **Cody Burke**

50 LightWave tips & tricks

TOP *Visiting Phone* Louis du Mont
BELOW *Tripod* Lino Grandi
BELOW RIGHT *Wine* Cody Burke

31 Use the Displacement Node editor to control an Item-Driven Morph in real-time

Depending on your workflow, sometimes it's nice to be able to control an object's morphs without having to stay inside the Morph mixer. I prefer to use an item, such as a Null with a ring shape, to control a lot of my morphs. Add a Null to your scene and give it a text label. Now go to Object Properties>Deform for the object with the Endomorph you would like to control. Enable the Edit Nodes checkbox and open it up. In here we are going to hook up a very basic node flow to get this working. Add these three nodes: Morph Map, Vector Scalar, and Item Info. First, tell the Morph Map node what Endomorph you would like to control and connect its position to the Input of the already existing Displacement node. You'll now see your objects morph in OpenGL go to 100%. Next, tell the Item Info node what item you would like to use – in our case it's the Null. I prefer to use the Null's rotation, so connect the output for Rotation to the input of the Vector Scalar. Using the Vector Scalar, you can select which H, P, B control you would like to use to drive the morph. I used the X Channel, which is Heading and then connected the Scalar to the Amount of the Morph map. Now rotate the Heading of your Null to control the morph. **Cody Burke**

32 Vertex Auto Weight

The Vertex Paint tool is a blessing when creating characters that require Weight maps assigned to each bone. With Skelegons created in Modeler you can auto-weight your character through the Vertex Paint tool under the Map tab in Modeler. Launching the tool opens a separate panel where, under the Weight and Calc tab, you can calculate weights with falloff options. You can test the deformation by Ctrl-clicking the selected bones and using T, Y and H for position, rotation and scale. **Louis du Mont**

33 Adjust camera ease

Something that's always nice to add to a camera movement is tension to the curves, so that the camera can ease in and out of its motion path. A simple example is if we animate a camera for our shot. On the first and last keyframes of the animation, set the keys tension in the Graph Editor to 1. You will see the curve change as this value is inputted. **Ben Cooper**

DYNAMICS

34 Soft Objects and Rigid Bodies

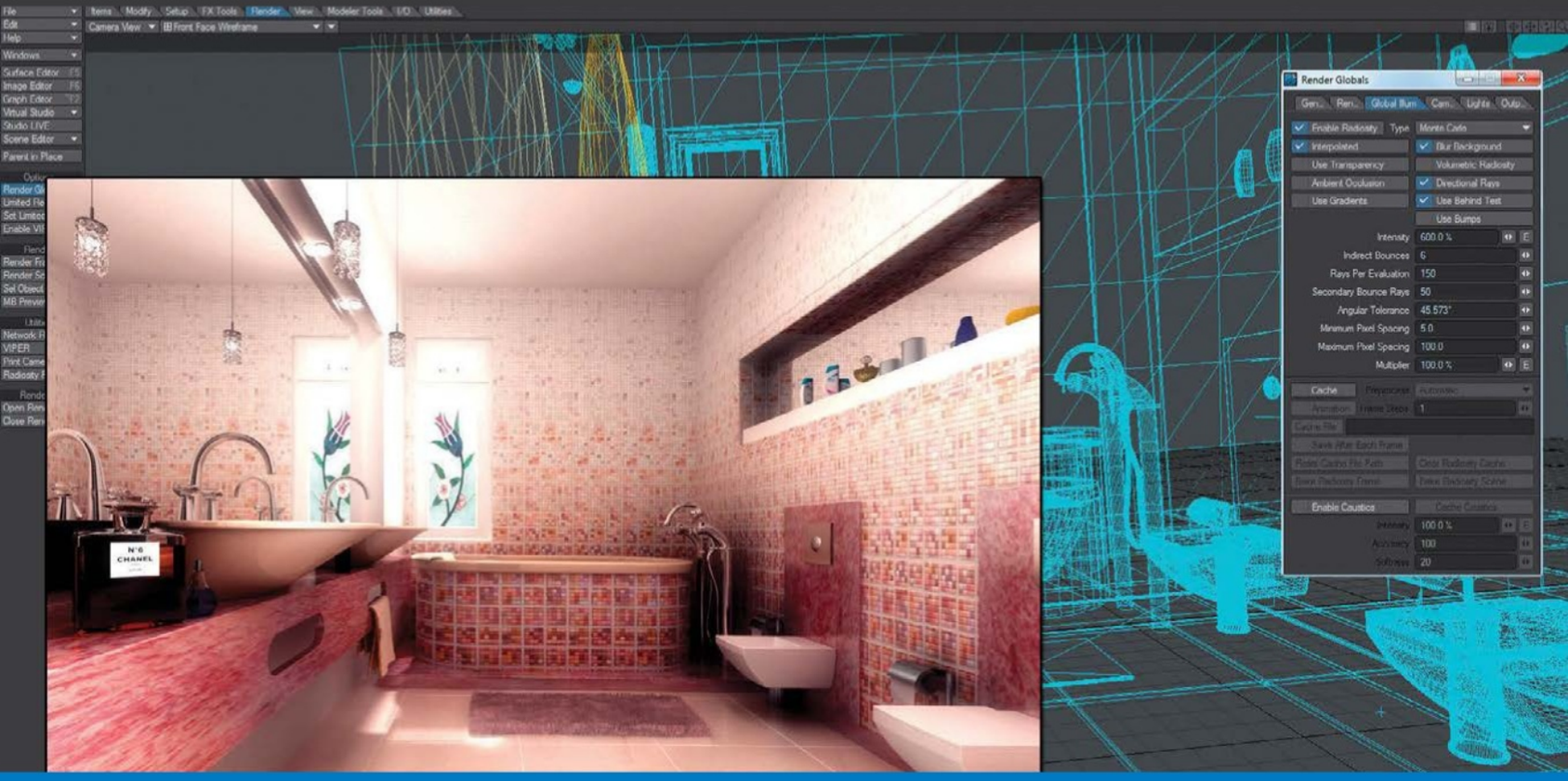
Something really useful, especially if we have to create a flag or any setup where we have a part of a cloth fixed to a rigid object, is the fact we can effectively move a part of a Soft Body into a rigid, kinematic or static mesh and have that specific part fixed to the mesh itself. Of course, that works both ways – we can create the base of a suspended bridge using a Soft Object and constrain rigid bodies to it. It's a natural and fast way to build very complex dynamics scenes with no effort. **Lino Grandi**

35 Controlled destruction

Setting the Glue Strength to 100% for a Parts Object provides great control on the choreography of a destruction scene. We'll need to deactivate the Breaking Angle and Distance and the parts will be kept glued. Animating a Null and adding a Distance to Object Gradient to the Glue Strength Texture channel will control where and when the Parts Object should break and collapse. **Lino Grandi**

36 Use Displacement and Bullet at the same time

It is possible to use Displacement (a procedural texture or an image generated in ZBrush) and Soft Body Dynamics at the



Tip 42

same time on a subpatch object. The best way to achieve this is to apply the Displacement through the Nodal Surface editor through an Input called Displacement. Anything connected to it will be visible activating the Bump Displacement option in the Object panel, after a Distance value has been specified. Subdivision Order must be set to After Displacement or After Motion, while you will need to choose Before World Displacement for your Displacement Order. **Lino Grandi**

37 Nodal version of Metalink

FX Hardlink and FX Metalink have always been very useful for linking the deformation of a high-poly object to a Cage mesh, but they rely on ClothFX or SoftFX to work. That means pre-calculation and caching is needed so we can see the final result. However, there's a Nodal version of Metalink that works perfectly in real-time and allows for complex networks and setups (so you can, for example, filter what should be affected using a Weight map), not to mention the perfect integration with Bullet Softbodies. **Lino Grandi**

38 Disable Dynamics

Any time that you're editing an animation or a Gradient in a Bullet scene – especially if it's a complex animation – it's always better to disable the Dynamics, since usually Bullet is trying to update the simulation in real-time, and that may slow down any changes a user wants to make. Don't forget to reset the simulation once the changes have been made, especially when you're using Nulls or other items to control Bullet parameters. **Lino Grandi**

LIGHTING & RENDERING

39 Use three-point studio lighting

This is probably the most common lighting setup, which is mainly used by photographers, but it's also incredibly useful for lighting scenes in LightWave. As the name suggests, it consists of three specific lights, including a key light, fill light and a rim light.
Key light This is the primary light source, often placed at 45 degrees in front and above the subject.
Fill light A fill light, sometimes called a kick light, is a softer secondary light source, which is used to lighten up and compensate for the composition's unflattering and unwanted shadowed areas. The fill is typically placed opposite the key light.
Rim Light A rim light is a strong, bright light source shining on the subject from behind, used to separate the subject from the background by creating a thin frame of light along the subject's silhouette.

However, you will see some problems with only a three-point lighting system in CG. In real life, light travels down, hits a surface and bounces back up, illuminating the surface it hits. In computer graphics, light travels down, hits a surface and passes through it, travelling on to infinity. **Sahin Michael Derun**

40 Additional light options

Bounce light This light is placed under the surface, where bouncing light needs to hit. It is often a point light with an Inverse Distance Falloff applied. The value depends on the range required of the scene. It renders fast, but you may need a pool of these little lights, depending on how big your scene is.
Global Illumination radiosity A Global Illumination system that calculates and simulates the bouncing light. It may make life easier setting up your scene, yet it comes with a price tag of much longer render times. From here on I'll go on explaining lighting with Radiosity. **Sahin Michael Derun**

41 Back up your HDRI lighting

When using HDRI images to light their scene, most people make the mistake of thinking that using an HDRI map alone will do the job effectively. Nothing can be further from the truth. In my experience, calculating the lights from the map results in fairly lengthy render times, not to mention that you have to set up high Radiosity settings to avoid unwanted render artefacts. Use the HDRI, but always make sure that you back it up with some additional lights to help with your render times. Never multiply your Radiosity. Instead, either change the gamma settings of your HDR map or use a higher Radiosity Intensity value. **Sahin Michael Derun**

42 Use Radiosity effectively

Radiosity settings often change depending on your scene and the lights you have active. However, most people try to use Radiosity in the Global panel. In return, they end up with proper lighting on some objects in the scene, while others are overexposed or simply too dark. This often happens because different surfaces need different light settings to stand out properly. Luckily for us, LightWave 3D provides another option, which can cut your test render times by half. Go to the Objects Property panel and activate Global Illumination only for the object that needs attention, and set your Global Illumination values there – it works every time. **Sahin Michael Derun**

43 Remove hotspots

You've made the perfect light rig for the shot and it may have taken a while to put together and get approval from the director, but halfway through the shot you suddenly get a hotspot that is jarring. The easiest way to fix it is to add an HDR Exposure filter to the shot, which can be found under the Image Filters in Layout. Upon adding the filter, we can increase the White Point value by increments of 0.1 to find the sweet spot. This pretty much eliminates brightness values that are above the threshold, but as a separate process once the frame has been rendered. Don't use too big a value because this has the potential to dull your image out. **Ben Cooper**

50 LightWave tips & tricks

Easy Life Louis du Mont

44 Create soft shadows LightWave has a great method of achieving quick and pleasing soft shadows in your shots. The LightWave Area lights are great to work with. Simply create the light via the dropdown menu and once you have the correct brightness and position, all you need to do is scale the actual light up. The bigger the light gets, the softer your shadow edges will become. The VPR is very useful for this procedure, as you can see your changes in real-time. **Ben Cooper**

45 Fast and accurate reflections As you may know, there is an abundance of ways to reach the same end goal in LightWave. The golden rule for reflection and diffuse is that the settings should equal 100 when added together, so if your Reflection is set to 20%, the Diffuse should be set to 80%. To get a nice reflection, some people might use a Gradient for the Incidence Angle in the Reflection channel, then use that same Gradient but inverted in the Diffuse channel. By using the Node Editor this is possible with the use of just one node, the Fresnel node. Enable the Node Editor in the Surface Editor and add a Fresnel node. Connect the Inverse output to the Diffuse input on your main surface, and the result output to the reflection input on your main surface. Feel free to play with the Refraction Index inside the Fresnel to increase reflections, but the default of 1.5 works well in most cases. If you do a comparison between renders you'll notice how much more realistic your reflections are when using the Fresnel node. **Cody Burke**

46 Depth of field rack focus One of the things my colleagues working with other packages have a hard time getting right off the bat is a really good depth of field rack focus. In LightWave, all images need to have some real-world camera properties applied to them to help with believability and to help cross the CG barrier. When working in 3D, especially in pre-vis, framing up the camera and applying real-world properties helps tell the story better and enhances the visual aspect. With Camera view selected, toggle on the DoF/Motion blur preview, then enable Depth of Field in Camera properties for instant interactive feedback for your camera. Bringing the f-stop down and adjusting your Focal Distance, you can see your depth of field in real time. Setting up a macro shot this way is a matter of pushing your camera close into your object. By lowering the f-stop and setting up key-frames in the Focal Distance animation envelope, you can set up a macro rack focus almost immediately with no render proofs and make adjustments in real time. If you do want a rendered view of this, you can switch over to VPR and see the depth of field in full render quality. **Steve McArdle**

47 Achieve crisp shadows by using a Dome light The Dome light is one of my favourite lights to use. Being able to dial in the sharpness or softness of the shadow with just a slider control is very beneficial when it comes to getting the exact type of look you are going for. Simply add a Dome light to your scene, or change the existing default Distant light to a Dome light and use the Angle degree towards the bottom of the light's Properties panel to adjust the sharpness of the shadow. A higher degree will result in soft shadows, while setting it to a smaller degree will result in tight, crisp shadows. I usually go for a setting between two and five degrees. **Cody Burke**

GENERAL TIPS

48 Match the perspective to the camera Cody Burke

A lot of the time we don't always move around the interface in the Camera View. Most of the time I find that I'm in the Perspective View and usually end up getting a really nice angle that I'd like to then render from. Well, we now have the ability to match the Camera's position and rotation to that of the Perspective. Simply select the Camera, then next to the OpenGL Texture Display Mode you'll see a small arrow to twirl down. Under Match Perspective you can either choose the existing Camera or add a new one. The camera will then snap into place and you may now render from that view.

49 Set the film back Louis du Mont

If you're working on a VFX shot, it helps to know the film back size so that you get the correct field of view when using matching focal lengths. By default LightWave's frame height is closer to Super 35, but if you want to mimic the look of your DSLR, you'll need to know the frame height. You can use the Real Lens Camera to load in the details from the metadata of an image taken with the camera that you work with. This will give you the sensor dimensions in addition to the focal length and pixel dimensions. However, the Movie modes on these cameras cut into to the sensor's height to get the required 16:9 aspect ratio. Below you will see a few frame heights that I have found useful in the past:
Full Frame 16:9 sensor frame height: 20.25mm
Crop APS-C sensor 16:9 frame height: 12.75mm
Red Epic sensor 16:9 frame height: 5k – 14.58mm, 4k – 11.664mm

50 Achieve fast subsurface scattering Brett Murrah

To create subsurface scattering quickly and easily I use the Fast Skin material shader in the Node editor. On a 1-metre sphere, I test render using the default materials until I find in the right look. In the case illustrated below, around 1m/2.5m works for the Epidermis Distance and Subdermis Distance. Make sure you have a nice, strong backlight with shadows. Mixing fractal colour patterns into the Epidermis Color and Subdermis Color will yield very cool results. As a note, this doesn't work with VPR and you may find occasional flickerings in your renders. To avoid this render double your final resolution, and then scale back down in your final composite.

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INSIDE THE SOFTWARE

We interview the developers behind the leading CG software used to create everything from Oscar-winning feature films to stunning games graphics

Going from computers that took up entire rooms and were capable of only the crudest of CG images, to the personal workstations of today that run software so powerful that anyone can create animations in their own home, has been no easy feat. It has taken many years and the dedicated work of thousands of artists who are, even today, pushing the limits of what computer graphics are capable of.

However, while we may see a list of modellers' and animators' names scroll past during a film's credits , the software developers themselves are often notably absent. Yet, it's thanks to their pioneering work that any of this has been achieved at all. Though we rarely think about it, we likely see something created using the software they've developed every single day of our lives.

To find out more about the people behind the tools, we spoke directly to the developers of the world's leading CG programs, learning how they go about creating and building this new, incredible technology that stands as the artist's latest, most highly sophisticated paintbrush.

Interviewees

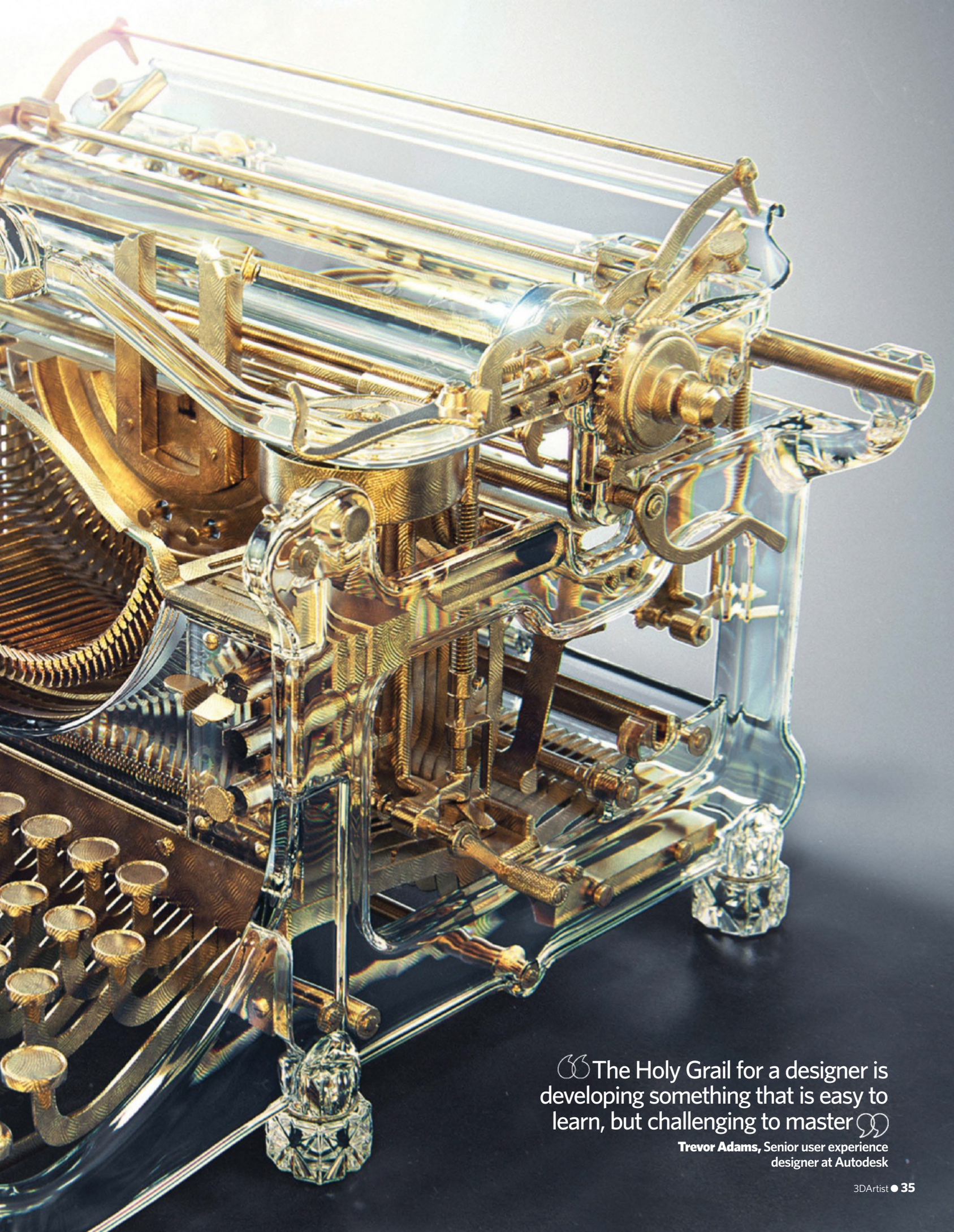
Autodesk
Trevor Adams
Gordon Bradley
Maurice Patel

Blender Foundation
Campbell Barton

Side Effects Software
Ed Lam

The Foundry
Matt Plec
Simon Robinson

Time Machine was made using Maya, mental ray and Photoshop by Aleksandr Kuskov, **www.behance.net/AleksCG**



> The Holy Grail for a designer is developing something that is easy to learn, but challenging to master

Trevor Adams, Senior user experience designer at Autodesk

Inside the software

Autodesk

Bio Founded in 1982 by John Walker and Dan Drake, Autodesk is a world leader in 3D design, engineering and entertainment. Autodesk delivers products that aid in the work of over 10 million customers, and has been included in *Fortune*'s list of 100 Best Companies to Work For. Along with the popular 3D software Maya, Autodesk also produces tools such as its flagship computer-aided design software, AutoCAD
Software Maya, 3ds Max, Mudbox, Softimage
Known for Having developed software that has been used in the last 19 Academy Award winners for Best Visual Effects. Recognised by the Academy of Motion Picture Arts and Sciences with two Scientific and Technical Achievement Awards this year for Mudbox and FiLMBOX, the foundation of Autodesk MotionBuilder. Autodesk scientists and technologies have been similarly recognised five times in past Scientific and Technical awards ceremonies
Interviewees **Trevor Adams** Senior user experience designer. Has been working at Autodesk for eight years in several roles, and started as a quality assurance specialist testing the software
Gordon Bradley Senior software architect. Has been working at Autodesk for 12 years
Maurice Patel Entertainment industry manager

How do you decide what features to put in your latest software releases?

Gordon Bradley I think that we definitely have creative freedom to explore future ideas ourselves as software developers, but a lot of the ideas and suggestions for new features really do come straight from the artists.

I think that when you look at the strength of 2015, it really has come out of asking people how we can improve the software. From there, we explore, we prototype, we play with a few options and we get feedback on them to work out the best way to tackle implementing each new feature. It really is a great process and I think that's something Autodesk has been getting right for a long time – working out how to involve the artist and the community all the way through development. That's kind of what leads us, I believe, to some of the really strong line-ups that we have today.

Can you tell us a little about tools such as Mudbox and XGen? What do you need to do when you take on new technology like this to get it into the hands of artists?

Maurice Patel The thing is, with technologies such as Mudbox, which actually came out of production technology in Weta, and XGen, which was production technology in Disney, is that very often our big customers will develop a toolset which is highly specialised, but it's not at all user-friendly. They're often very interested in getting this technology into the hands of other artists, so we partner with them to help them.

I remember when we announced that we'd signed a deal with Disney for XGen and everyone was asking where it was and why it wasn't in the next release. It takes years of work to make these tools user-friendly – there's actually a lot of expertise involved in taking these technologies and making them better suited for a broader audience rather than just specialists within huge companies.

What are your main goals when working on software such as Maya?

Trevor Adams The Holy Grail for a designer is developing something that is easy to learn, but challenging to master. It's like picking up a musical instrument like a guitar: you can quickly just strum away at some cords and make some noise.

Gordon Bradley This is something we've said in Maya for a long time – our job is to hide the maths. That's what it comes down to. Over Maya's history that's what we've constantly been trying to do. Hide the maths and let the artist focus on what they want to focus on, which is really telling a story, whether it's film, television or game.

What have been the main challenges and successes of your job developing Autodesk's solutions over the years?

Maurice Patel Honestly, you could write a book about it! Ultimately one of the things that we're very proud of is that we've had a lot of successes. I mean, we've won seven Academy Awards for the technology, whether it's Maya, Flame, or now Mudbox and MotionBuilder.

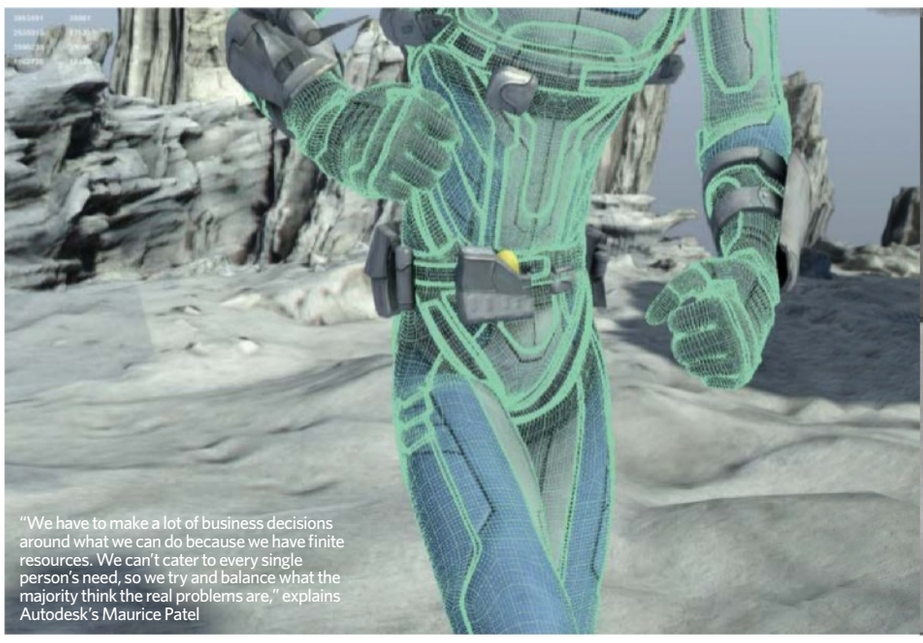
The challenges are many. When you're a technology developer and people want new things, we have to really balance supporting what we would call legacy versus developing something new.

We did this in Flame – it had a very distinctive user interface. All the buttons were placed in very specific areas and were designed to be driven with a

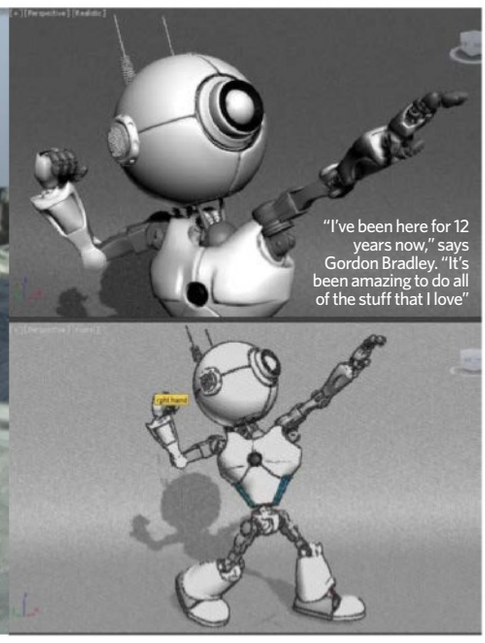
THE PERKS OF THE JOB

"I think the biggest reward for me is hearing from artists," says Gordon Bradley, senior software architect at Autodesk. "When they've picked up a tool that you were a part of and they talk about what they did with it and how much better it made their working life, that's why I'm here. It never fails to make me smile, especially if they don't know that you worked on it."

"Definitely," agrees Trevor Adams, senior user experience designer. "You do feel like you're part of it, even though you're essentially behind the scenes. Even reading articles like in **3D Artist** about the new features that are coming out is rewarding in itself, to realise that it's real, it's in the application and it's no longer being tested. To have so much positive feedback inspires you to work even harder because people are paying attention and appreciating it."



"We have to make a lot of business decisions around what we can do because we have finite resources. We can't cater to every single person's need, so we try and balance what the majority think the real problems are," explains Autodesk's Maurice Patel



"I've been here for 12 years now," says Gordon Bradley. "It's been amazing to do all of the stuff that I love"

WACOM tablet using muscle memory, just like touchtyping with a keyboard. You could run this product without ever looking at the user interface. This is another product that has been around for 20 years and for its twentieth anniversary we redesigned it to make it more modern, but there was huge resistance at the beginning, of course. These are people who can sometimes charge between 500 to 1,000 dollars an hour for their work and all of a sudden you're impacting their productivity by changing what they're used to!

How do you decide what features to let go of if you have developed something that does manage to do things better?

Gordon Bradley This is something that historically we didn't do very well and it resulted in a lot of complexity in the product. Our goal is never to pull the rug out from right under people's feet, but I think that by and large there are so many advantages to moving to the new stuff. As soon as the artists let us know that they're ready to move, we do try to keep it as streamlined as possible.

Trevor Adams Absolutely, that's where the beta program comes into effect. For example, we reintroduced Multicut, a way to cut up your polys in Maya, but I could probably count about five or six different tools in Maya 2014 that essentially do similar things. Our goal with the 2015 release was to change this. We focused on this one tool for several months to make sure that the new version of Multicut comprised of all the features of the previous tools and then finally allowed ourselves to start deleting things. In 2015, you don't have Interactive Split or a Split Polygon tool anymore.

We have to ask – why did Autodesk decide to discontinue Softimage?

Maurice Patel Typically, these types of decisions are business decisions and are not made by the developers, although their analysis on the feasibility of various plans is a very critical factor in determining the right course of action to take. This decision was not really made from a perspective of merging technologies, but from a need to free up more resources to increase the rate of development and innovation on our more popular products, such as 3ds Max and Maya. It is our intention to take elements from Softimage and incorporate them into 3ds Max and Maya where appropriate.

What are you most looking forward to from the 2015 releases?

Trevor Adams What I'm looking forward to in 2015 release is seeing people start realising that modelling in Maya is just more fun, and what I look forward to in the future, being the modelling designer, is to continue on that front. I want to make Maya that application you can just open up – you don't really have to read anything about the application, you just pick it up and start playing around and you start building models. I'd like people to be able to get that kind of instant gratification from using our software.

DEVELOPING V-RAY

Lead developer and Chaos Group co-founder Vlado Koylazov discusses his experiences creating and developing the major renderer, V-Ray, which started life as a small raycasting engine Koylazov wrote to obtain volumetric shadows.

What are the key things you need to keep in mind when building a good renderer?

It depends on what the renderer is used for. For example, a game engine could be a good renderer for its purpose, which is real-time interactive graphics. REYES-style renderers were favoured for a long time for visual effects because of their ability to efficiently render very detailed geometry and camera effects like depth of field and motion blur. Raytracers are good for photorealistic rendering and so on. In my opinion, though, a good renderer should be functional in a wide variety of situations.

The main challenge is that there are no ready solutions for many of the things that we want to implement, so we need to do quite a bit of research to find out good ways of solving particular problems. Specific things that I am particularly proud of are the light cache and V-Ray's proxy geometry system. Both have proven to be very successful approaches for GI and heavy geometry rendering to the extent that they are now considered a must-have for any render engine.

Is there any challenges specific to developing renderers that may not be encountered when working on other computer graphics software?

There are difficult problems to solve in any field, but the main challenge with rendering is understanding the underlying theoretical framework and how the numbers come together to form a final image. Getting the most out of the available hardware, CPUs or GPUs has also proven to be a major challenge.

V-Ray 3 for Maya Beta has just been released © Nick Gaul

Autodesk's switch to providing software rental options "allows our developers to be even more responsive rather than focusing on big, annual releases," says Patel. "It allows us to be more flexible creatively."

Inside the software

Blender / Blender Foundation

Bio A Dutch public benefit corporation, created to support and facilitate projects on **www.blender.org**
Software Blender
Known for Blender is regarded as the most sophisticated open-source 3D software in the world. It is actively developed by hundreds of international volunteers, including artists, VFX experts, hobbyists, scientists and more
Interviewee Campbell Barton Active with Blender since 2003 and lead developer since 2007

What exactly would you describe as a typical day at work?

Mostly I start by checking our bug-tracker for any new issues and check on any changes made to Blender overnight. From there I'll move on to development – I do a lot of bug fixing and reviewing the code, but also general improvements or features.

There are so many ideas flying around that most Blender developers get bombarded with requests from users. Often, by the time we get around to working on a new feature, it's been on our to-do list for a while. We get a lot of freedom to develop areas we find interesting and that's one of the reasons I really love to work on Blender – but that's balanced with the need to keep the software working and stable, which takes up our time too.

A huge part of what makes Blender special is that it is free and open-source. How does this impact on you as a developer? Also, might we ever see a future where this isn't the case for Blender?

This is hard for me to answer, as I have never done any serious closed-source development. I'll just say that I really like the openness and transparency that we have with other developers and our user-base. We can ask users who want to test a new feature to test a nightly build without them needing to be a part of some kind of beta-program, while users who report bugs even send in fixes occasionally because they are able to download the source code and build upon it themselves.

As for Blender one day getting locked up – in practice, it would mean getting the hundreds of people who own copyright on our code to agree. There's a lot written on this and you could ask the same question for Linux, Firefox or Wikipedia – but users, rest assured, we'll stay free and open! This is fundamental to the software.

> "...you could ask the same question for Linux, Firefox or Wikipedia – but users rest assured, we'll stay free and open!"
>
> **Campbell Barton, Lead developer at The Blender Foundation**

Images from Project Gooseberry, a project in which the Blender Institute will bring together 12 indie studios from around the world to contribute to an animated film

We loved the new website and plans for 2014/15, as well as Project Gooseberry. Can you tell us more about the changes you're working on implementing today?

For the UI we have long term plans to investigate tool access and the toolbar. Some features in Blender aren't very obvious, so we need to improve on that, as well as lots of smaller changes we do as a part of regular development with guidance from our UI team. Today I'm looking to develop some mesh modelling tools to intersect selected geometry – a little like booleans that can be used in Edit mode without setting up modifiers.

What are the best ways that 3D artists and users can help with the future of Blender?

I could recommend donating to the Blender Foundation or buying a t-shirt, but while this does help very much, I think its a short-sighted answer.

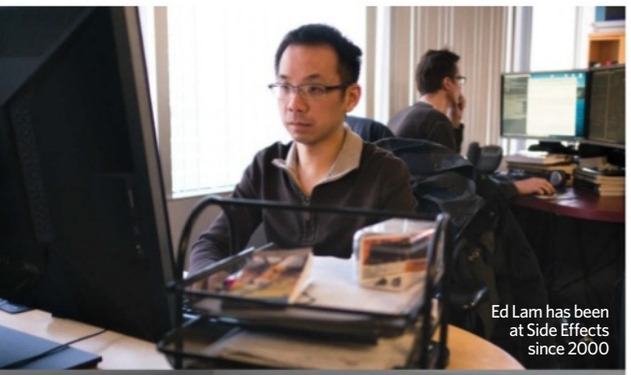
I'd suggest to start small and get involved with the online community, even asking good questions on sites like **http://blender.stackexchange.com** helps. Answering questions, making tutorials and improving wiki documentation helps too, but not everyone can do that to begin with.

Another way to help is by funding development. If you miss some feature, it may be possible to have it written as an add-on or extension. My personal aims for the future are to help with getting more developers involved – this is something that we desperately need if we are to continue growing.

What are the top features you think the best CG software should always have?

Smooth workflow When you perform actions frequently, having to be prompted with dialog boxes each time can really slow you down.
Interactive feedback and previews When artists are changing values for materials, simulations and so on, they need to get quick feedback so they aren't just guessing and having to wait a long time to see results. For areas such as physics simulations this isn't easy, but it's still something to aim for.
Consistency With 3D applications in particular there are many similar concepts mixed together. Consider selecting a vertex. That doesn't just apply to meshes, but also the Animation Curve editor, UVs, image masks and key frames in the dopesheet. If the user has to learn different rules for each one, it takes longer to get used to and muscle memory from one area won't apply to another.
Extensible While the base set of tools should cover common use cases, in my experience there are many special cases that come up when working on 3D projects, so it's important that applications can be extended. While all of the popular 3D applications enable this at some level, they vary considerably in their approach and the kinds of extensions they support.

On the software side, I'd really like to improve on Blender's extensibility. This means better integration with studio pipelines as well as the ability to use Blender as the basis for other tools.



Ed Lam has been at Side Effects since 2000

"To paraphrase Einstein, the UI should be as simple as possible, but no simpler," says Ed Lam, senior product architect and veteran developer at Side Effects

© Art Pictures Studio, Non-stop Production. Image courtesy Main Road|Post

WHAT IT TAKES TO BE A SOFTWARE DEVELOPER

From Blender's Campbell Barton

"The obvious one for any developer is to be a good problem solver. Beyond that, here are some qualities I think are more specific to computer graphics:

Design Even though many developers wouldn't consider themselves UI/UX designers, often we need to expose complex functionality to users without just presenting a grid of options. Getting the balance right between user control and ease of use isn't easy.

Maths There's no denying that computer graphics can involve fairly advanced maths, so it is an advantage to have a good background here. However, in the same breath I think some people overestimate this. There are many areas of graphics software that don't require really advanced maths and developers can learn some along the way when needed.

Communication Considering a lot of open-source software is written by online teams, developers have to be able to communicate well so that the project runs smoothly. It's important that the developers take the time to understand the needs of users and can engage with them to help get the best results.

Discipline It seems many areas of software development are moving away from low-level languages like C/C++ to Java/.NET and scripting languages, however with computer graphics, the performance benefits of lower-level languages often can't be ignored.

Houdini / Side Effects Software

Bio Starting out at a pioneering company in the emerging world of computer graphics, Omnibus, Side Effects was born from Kim Davidson and Greg Hermanovic's desire to bring 3D graphics to a wider audience with PRISMS, a procedural graphics application, which laid the groundwork for Houdini
Software Houdini
Known for Twice recognised by the academy of Motion Pictures, Arts and Sciences for Houdini and it's procedural based technology. Houdini has been used in some of the most VFX-intensive films of recent years, such as *Ender's Game*, *Gravity*, *Pacific Rim* and *Star Trek Into Darkness*
Interviewee Ed Lam Senior product architect and veteran developer at Side Effects

What inspired you to start developing computer graphics software at Side Effects?

I was drawn to computer graphics ever since I first started learning programming as a kid. I have fond memories of writing programs on the TI-99/4A that would draw colourful patterns on the monitor, as well as writing a simple drawing program with my friend on his VIC-20. I enjoyed the feeling of creating something visual with the computer, and being able make it interactive was icing on the cake.

During my university internships, I tried a few different areas but I came back to my first love in the end, computer graphics. I had briefly worked at another, much larger 2D graphics company during an internship, so when I graduated I was looking for someplace smaller, where I could have a greater impact. Side Effects Software fit the bill perfectly. The team at the company was small and they developed an incredible program called Houdini that was used to create visual effects on blockbuster films. It was very cool for someone embarking on their first real, full-time job in 2000. Here I am today, still at Side Effects.

What is it like as a developer at Side Effects, and what are your goals for the software?

The culture at Side Effects is extremely creative. The main sources of inspiration come from artists and technical directors, as well as each other on the team. Side Effects has a great rapport with the users. I rarely go a day without talking to an artist or TD. The developers are constantly working together on different things and share the challenges they face in their respective areas of the package. This creative process mingles a lot of ideas together and provides lots of food for thought. Beyond the usual public feedback mechanisms and support channels, we also hold special discussion events that we call Houdini Forums. They are held typically twice a year in London and Los Angeles. A cross-section of companies are invited with a good mix of competencies to solicit how we're currently doing and to act as sounding boards for wild ideas.

We're not shy about replacing old parts of the architecture in major projects that sometimes span multiple years and releases. For example, Houdini 12 sported a rebuilt geometry core and Houdini 13 introduced a new particles architecture. This is what keeps the software fresh and scalable after all these years. Since Side Effects is a private company, we can afford this important luxury due to the fact that we are fully in charge of our destiny. Ultimately, our goal is to do right by our user base.

For you, what are the easiest ways in which a beginner can start to learn the software? What methods would you suggest?

For starters, go to **www.sidefx.com**, click on the menu at the top and go to Learning>Getting Started, which has a good set of introductory lessons. If you scroll down to the bottom of this page you will find a link to PQ Houdini. Artist extraordinaire Peter Quint has over 100 tutorials on his Vimeo channel.

There are more tutorials under Learning>Tutorials. In addition to the usual ones, the Master Classes are unique. They are advanced, in-depth topic videos presented by the software developers themselves.

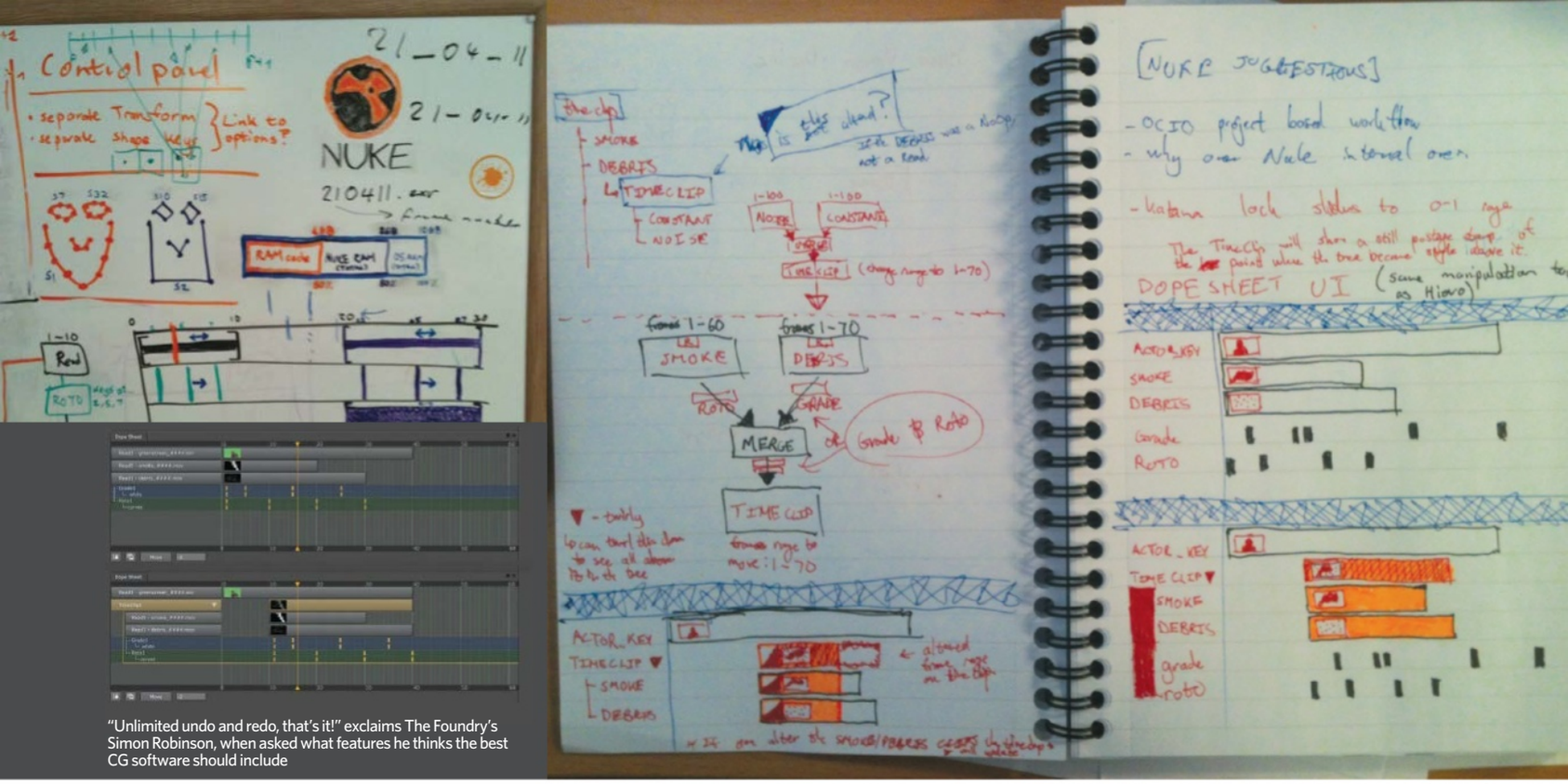
> "Don't just learn in a vacuum. Learning from tutorials gives the basics, but it isn't a substitute for trying things out yourself – don't be afraid to ask the community for help in our web forums"
>
> **Ed Lam,** Senior product architect and veteran developer at Side Effects

Don't just learn in a vacuum. Learning from tutorials gives the basics, but it isn't a substitute for trying things out yourself – don't be afraid to ask the community for help in our web forums.

How do you go about deciding what new features to add to Houdini?

The power of Houdini lies in its flexible procedural nature. Whatever it is that I'm implementing in Houdini, I'm always thinking of how to not only make that feature useful for the task at hand, but also to ensure that it is extensible so artists can take it to the next level in ways that we can't envision. We're often taken by surprise at how imaginative the Houdini community is, using tools in ways that we'd never even thought of in the first place.

I believe that software needs to be heavily used before all features can be discovered. We're not perfect, so being open with the community and making daily builds available really helps to improve the software. As a programmer, it is vital to have strong software engineering skills. With a large code base like Houdini's, it's always challenging to ensure that complexity is kept at bay while adding features.



"Unlimited undo and redo, that's it!" exclaims The Foundry's Simon Robinson, when asked what features he thinks the best CG software should include

NUKE / The Foundry

Bio A global developer of computer graphics, visual effects and 3D design software for the design, visualisation and entertainment industries with offices in London, Los Angeles and Silicon Valley
Software NUKE, MARI, MODO, KATANA, FLIX
Known for Software used for Oscar-winning feature films, television, games and design. Recent awards include wining the 2013 HPA Engineering Excellence Award for FLIX and an Academy Technical Achievement Award for its work on KATANA
Interviewees Matt Plec Senior product designer, originally part of the commercial development team on NUKE
Simon Robinson Chief scientist, from a background in computer algebra systems

Do you feel it's possible to develop computer graphics software without being a 3D artist? How is this done?

Simon Robinson The engineering of a complicated piece of software needs lots of different disciplines, ranging from the extremely technical details about software architecture, to the look and feel and user experience. You can get a lot done without being an artist yourself, but you certainly can't do it without knowing how users need to work, and you can't do it without great respect for what they produce.
Matt Plec When you spend time working in a piece of software – and some of our customers spend a lot of time in our software – you notice small, but really important things. Our engineers need that kind of time to do the development work, too, so the feedback and interaction with customers, product designers and creative specialists is invaluable.

What's changed about 3D software development since you began?

Simon Robinson These days I do very little coding. I've been replaced by more talented people! At the start of my career, working in production, I was thrown a fresh challenge pretty frequently. I worked long and extremely antisocial hours, always working out how to persuade software to generate an image that was good enough from the required angles for long enough to be convincing. Over the years, as The Foundry has grown up, development has become increasingly organised, so that engineers' time here is more reliably scheduled. There's still a lot of stress and hard work involved though, and the antisocial hours still remain a part of the industry.

Are there any other difficulties you could expect as a software developer?

Simon Robinson We sort and discard our ideas by asking clients what they think and by constantly quizzing them about what it is we're making, who it is meant for, in what market and – because this is a business, at the end of the day – how much the people in those markets think our work is worth. Then within the development process itself, there's lots of debate about the cleanest way of doing something, questioning whether something from another team or another project could be reused. There's a lot of process involved, but there is a lot of experience needed to make the right choices.

We also have some highly technical software. When you open it, it feels a bit like stepping into the cockpit of a 747. You wonder if it really needs all those buttons. It may be intimidating, but it has a purpose. Yet, at the same time there is a greater drive to software being more accessible – can an artist pick the software up within five minutes of opening it for the first time and immediately be productive? The line between simple and complex is a trial and error process and it's constantly evolving.

Do you feel this is a job that could not be possible without feedback or beta testing?

Simon Robinson Feedback is as important as typing the code in the first place. Too many projects become unstuck because developers are overly confident about the brilliance of their own ideas!

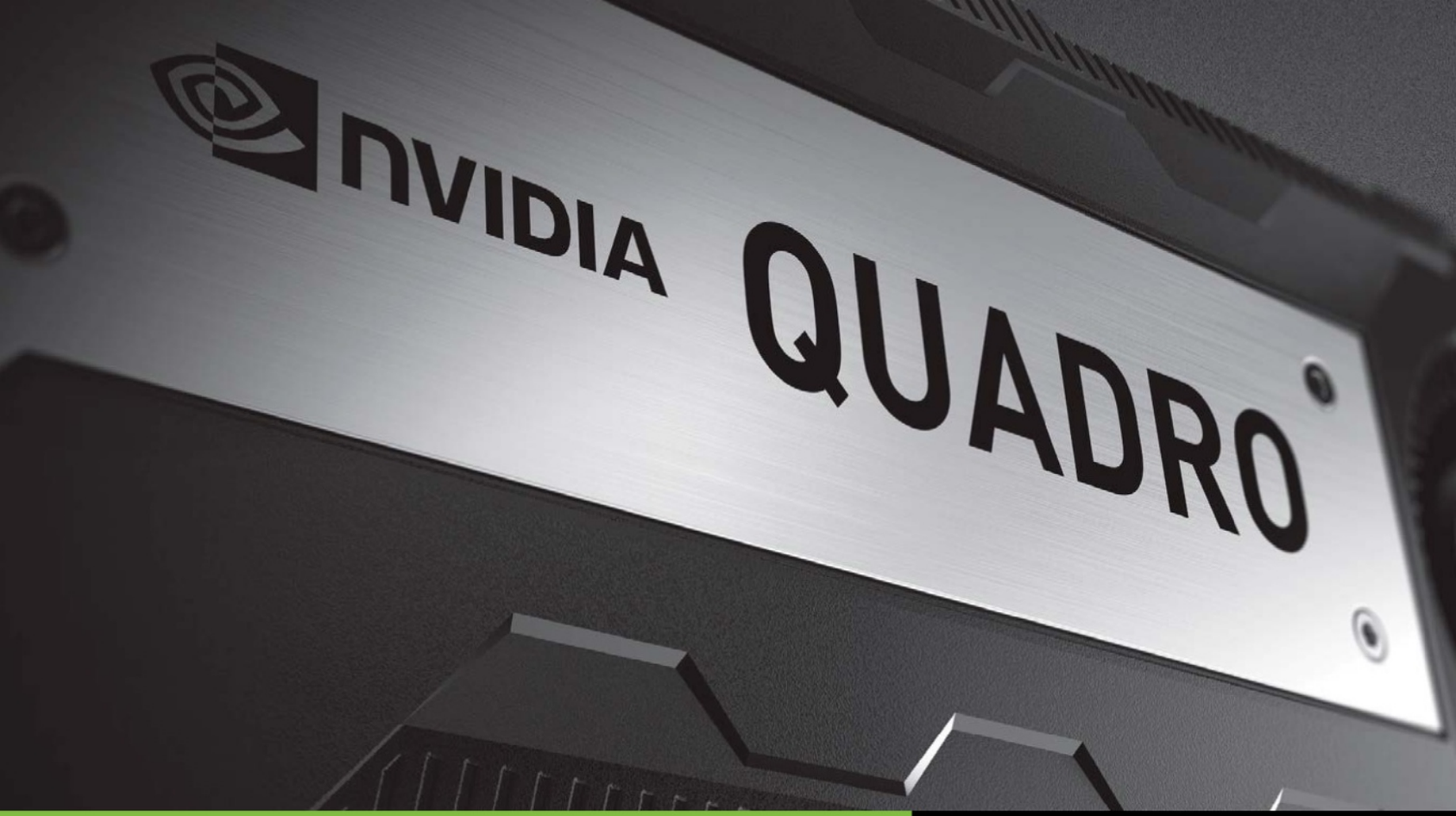
How can 3D artists and users help influence the development of NUKE, KATANA, MARI, MODO and your other software?

Simon Robinson Feedback, engage, criticise! Come in for a cup of tea and tell us what you think! Feedback is paramount to our improvements.
Matt Plec In your feedback and criticism, try to help us understand the root of the issue. Sometimes someone says, 'you need to add a button for X', but when we dig deeper and ask why, we find we can actually do something that will solve that problem and much more. The 'why' is really important, all the more so because we're not the ones using the software all day every day.

What would you most want to implement at The Foundry within the next five years?

Simon Robinson Quite seriously, if we said confidently that we knew exactly where we would be in the next five years, we would be lying and you should ignore us.
Matt Plec I'll take the bait – I don't want to wait for updates when I'm working interactively but if I have to, I would like to be able to control the render quality more finely than Proxy On/Off. If I can get hold of more machines to do some of the computing, I would like to be able to use them effortlessly whenever or wherever they're available. Iterations should be faster so we can experiment more. If I'm honest, that's just the start of a very long list.

> "You can get a lot done without being an artist yourself, but you can't do it without great respect for what they produce"
> **Simon Robinson, Chief scientist, The Foundry**



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HOW 3D PRINTING WILL SAVE YOUR LIFE

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Director of the Wake Forest Institute for Regenerative Medicine / USA

Professor Lee Cronin
Regius Chair of Chemistry / UK

Dr Andrew Dawood
Co-founder of Dawood & Tanner, Digits2Widgets and Cavendish Imaging / UK

Scott DeFelice
CEO of Oxford Performance Materials / USA

Joseph DeRisi
DeRisi Lab / USA

Mick Ebeling
CEO and co-founder of Not Impossible Labs / USA

Elliot Kotek
Content chief and co-founder of Not Impossible Labs / USA

Thomas Most
Prosthetic-orthotic CAD/3D printing specialist / USA

Suman Mulumudi
CEO of StratoScientific Inc, inventor / USA

Professor Raphael Olszewski
Surgeon and head of the university's oral and maxillofacial surgery research lab (OMFS Lab, UCL) / Belgium

Michael Renard
Executive vice president of Organovo / USA

Whitney Sample
Nemours / Alfred I. duPont Hospital for Children / USA

Professor James Yoo
M.D., Ph.D., Professor at the Wake Forest Institute for Regenerative Medicine / USA

From prosthetic limbs to fully functional organs, we look at how 3D printing is revolutionising more than just the manufacturing industry

3D printing will be the next industrial revolution. With the technology having become ever cheaper and more accessible over the last several years, this is a future many have been quick to predict. What if, though, we could use 3D printers not just to revolutionise the manufacturing industry, but to save lives as well?

Being able to print out custom-made artificial limbs, prosthetic noses and even human organs may seem like science fiction, but by utilising 3D printing for applications within the medical industry, this is fast becoming part of our everyday reality. Just last year, California-based company Not Impossible used 3D printers to produce hands and arms for amputees in Sudan, giving a teenager the ability to feed himself for the first time since war had left him disabled at 14. In January this year, 3D bioprinting company Organovo launched the world's first printed organ product – a functional slice of human liver.

"November 3 2013 – remember that date," begins Prosthetic-Orthotic CAD and 3D printing specialist, Thomas Most. "It was huge, because it was then that the UK's Fripp Design and Research made the first successful 3D printed silicone. People have been trying to do that for 15 years and they did it. I felt the first piece in my hand and thought 'holy cow, this is huge'.

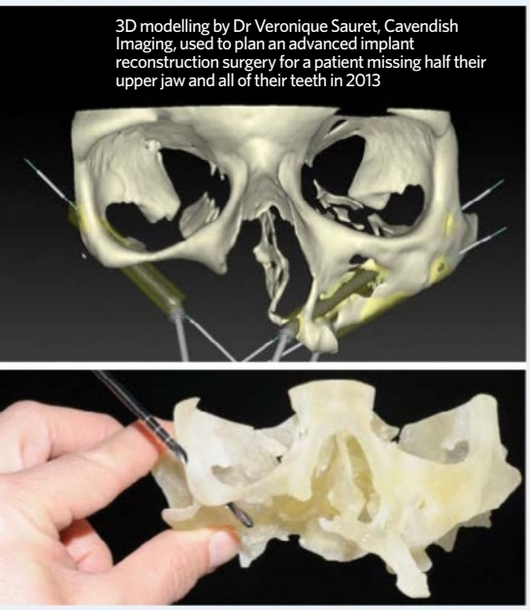
"Say somebody was missing an eye from cancer or trauma," continues Most. "These days prosthetics have to be moulded and cast in silicone, but once the machines are available, you could digitally sculpt or scan their face and then you could send it as a file directly to the silicone printer. It would be made without mould or casts so the cost would come down dramatically and save a huge amount of time." Other materials have huge advantages too. Most explains that joints and even spinal surfaces made out of titanium could be produced not only to be more lightweight, but also in such a way that enables the surrounding bone tissue to grow into the device so that it almost becomes part of a patient's body. "It's no longer just a titanium piece that has been machined to be the same as any other – a foreign object jammed into the top of your femur," beams Most. "Now, your femur grows around it and encompasses it so that it's even stronger – it's a part of you."

To Most, who recently used CAD to create a fully 3D printed socket – a device usually used to help connect an artificial limb to a patient – there are absolutely no downsides to using the technology. The socket he produced turned out to be half the cost and weight, as well as much stronger than any alternatives on the market. Most's been presenting his paper featuring the results at venues across the world ever since.

How 3D printing will save your life

One of the advantages of 3D printing from the start was the speed of going from an idea to a prototype, plus the accuracy of it

Whitney Sample, Nemours/Alfred I. duPont Hospital for Children



3D modelling by Dr Veronique Sauret, Cavendish Imaging, used to plan an advanced implant reconstruction surgery for a patient missing half their upper jaw and all of their teeth in 2013

+ BUILDING THE ARTIFICIAL LIMBS OF THE FUTURE

The biggest challenge to overcome now is education. According to Most, as many people as possible need to know about the incredible things medical 3D printing can do. "As of January this year in the States, all the orthotics and prosthetics schools – none of them were teaching CAD or anything you need to know in order to manipulate the file so that it's printable, which blows my mind," he tells us. "As far as I'm concerned, they're missing the boat. I'm talking about being able to make a custom artificial device to replace a body part that's a better fit from the get go, and actually enables you to treat patients faster. I predict that in three to five years, if they don't get on board with some of the scanning and printing technology, it's going to be taken away from them by other franchises."

It's easy to get caught up in the figures – the fact that a 3D printed artificial limb can cost thousands of dollars less than lower quality alternatives is certainly exciting, and is a winning argument against any 3D printing naysayers. However, such cold, statistical facts can get in the way of the simple human factor that makes these achievements truly newsworthy – 3D printing can change a life, forever.

It was in war-torn south Sudan that Daniel, a 14-year-old who considered his life no longer worth living after having lost both arms to a bomb, found himself the focus of Not Impossible Labs founder Mick Ebeling's attention. The California research firm aims to provide low-cost, open-source solutions to previously insurmountable healthcare issues. In this instance, by using simple, consumer-grade MakerBot Replicator 2 Desktop 3D printers, Not Impossible was able to print out the parts to produce a full prosthetic arm, on-site, in less than six hours. Without the need for expensive medical treatment or to walk miles in search of a specialist prosthetics centre, Daniel was able to feed himself for the first time in two years.

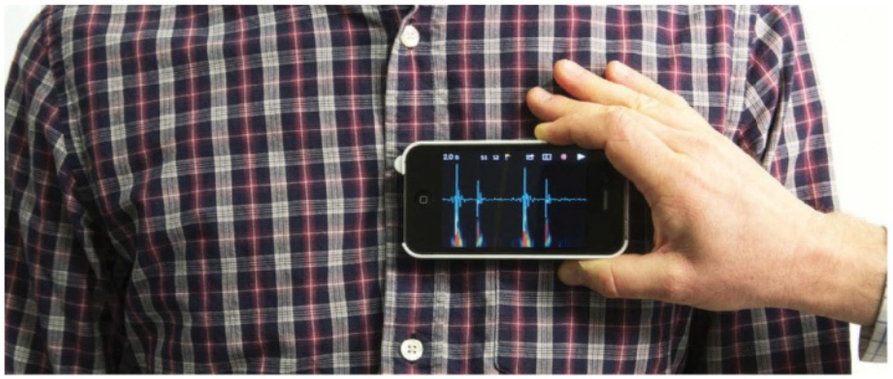
Following the success of Daniel's new arm, Ebeling and the team set up the world's first 3D printing prosthetic lab and training facility to teach others to print and assemble the 3D prostheses. A little more than a week after Not Impossible Labs had been back on US soil, four more arms had already been built. "We're hopeful that people in other regions of Africa, as well as other continents around the globe, will utilise the power of this new technology for similar beginnings," Ebeling explains. "We believe that Daniel's story will ignite a global campaign. The sharing of the prostheses' specifications, which Not Impossible will provide free and open-source, will enable any person in need, anywhere in the world, to use technology for its best purpose: restoring humanity."

Like Not Impossible, the team at the non-profit Nemours Foundation was also inspired to use 3D printing due to a child who needed help that existing methods could not resolve. "It really started kind of by accident," begins Whitney Sample, research designer at Nemours/Alfred I. duPont Hospital for Children. "Prior to the 3D printer we were still

iPhone to stethoscope

After building a MakerBot Thing-O-Matic with his class at school, student Suman Mulumudi spotted a major gap in modern medicine. Inspired by his father, who works as a cardiologist, he designed the Steth IO, a device that enables a smartphone to double up as an audio-visual stethoscope, and 3D printed it. Today, he's started his own company, StratoScientific Inc, and aims to design even more innovative products. "One of the most empowering parts about being exposed to 3D printing is that it opens up your mind to thinking in different ways," explains Mulumudi. "Without realising it, I believe we often limit our thought process by what we think we can produce. The future of healthcare lies in its ability to individualise healthcare to suit the patient and for the first time this is truly possible with medical 3D printing."

The Steth IO prototype and how it would work as very accessible stethoscope



Daniel and a friend, showcasing their new 3D printed artificial arms. The prosthetic arms enabled Daniel to feed himself for the first time since he lost his arm two years earlier

designing devices for children with disabilities, but used other fabrication manufacturing tools. One of the advantages of 3D printing from the start was the speed of going from an idea to a prototype, plus the accuracy of it. With most other machining processes there is a fair amount of mechanical skill involved to get good results. That's bypassed with the 3D printing process because you're going straight from CAD to printed model."

The patient that changed everything was two-year old Emma, who was born with arthrogryposis multiplex congenita, or AMC, a non-progressive condition that causes stiff joints and underdeveloped muscles. With the help of WREX (Wilmington Robotic Exoskeleton) – a device Sample and Tariq Rahman, head of pediatric engineering and research at Nemours, had already developed – she would be able to lift her arms. The only problem was that WREX had been created for wheelchair users, while Emma could walk.

"We needed to make something lighter and much more adaptable to her lifestyle, and it just so happened that we had a Stratasys 3D printer right around that same time," Sample remembers. "The fact that we could make WREX lighter and could replace parts quickly was amazing. We could constantly make design adjustments and test them out on Emma for the best comfort and mobility." For Sample, a future in which equipment for children like Emma can be printed at home, with parts replaced and customised as they grow, isn't too far off. "Humans like custom-everything," he explains. "Look at your iPhone case. People want the same iPhone, yet everybody wants a different case. Throw into the mix disabled people, who actually need custom-everything as unique adaptations to deal with their disability – it's a perfect match for 3D printing. All you have to do is make adjustments to a file. Alternatives like injection moulding cost close to $10,000 to mould for one part and that's not even a complex part. You can get printers for just a couple hundred dollars now, so it's just a matter of time before the rise of this new way of life. It's inevitable."

+ GOING DEEPER

Where we're likely to start seeing the biggest shifts towards universal adoption of the technology, however, is dentistry. There are already several dentistry-only 3D printers on the market, offering the ability to work with materials such as porcelain, metals, soft plastics and even wax. "Of course, dentists tend to have a lot of extra money to buy all the tools they need," Sample remarks, "and with 3D printing, they can go straight from the MRI scan to making a retainer, a crown or any type of mouthpiece. Not only can treatments be specifically designed for each mouth, but physical positives and casts of a patient's mouth don't need to take up storage space any longer. Everything is digital."

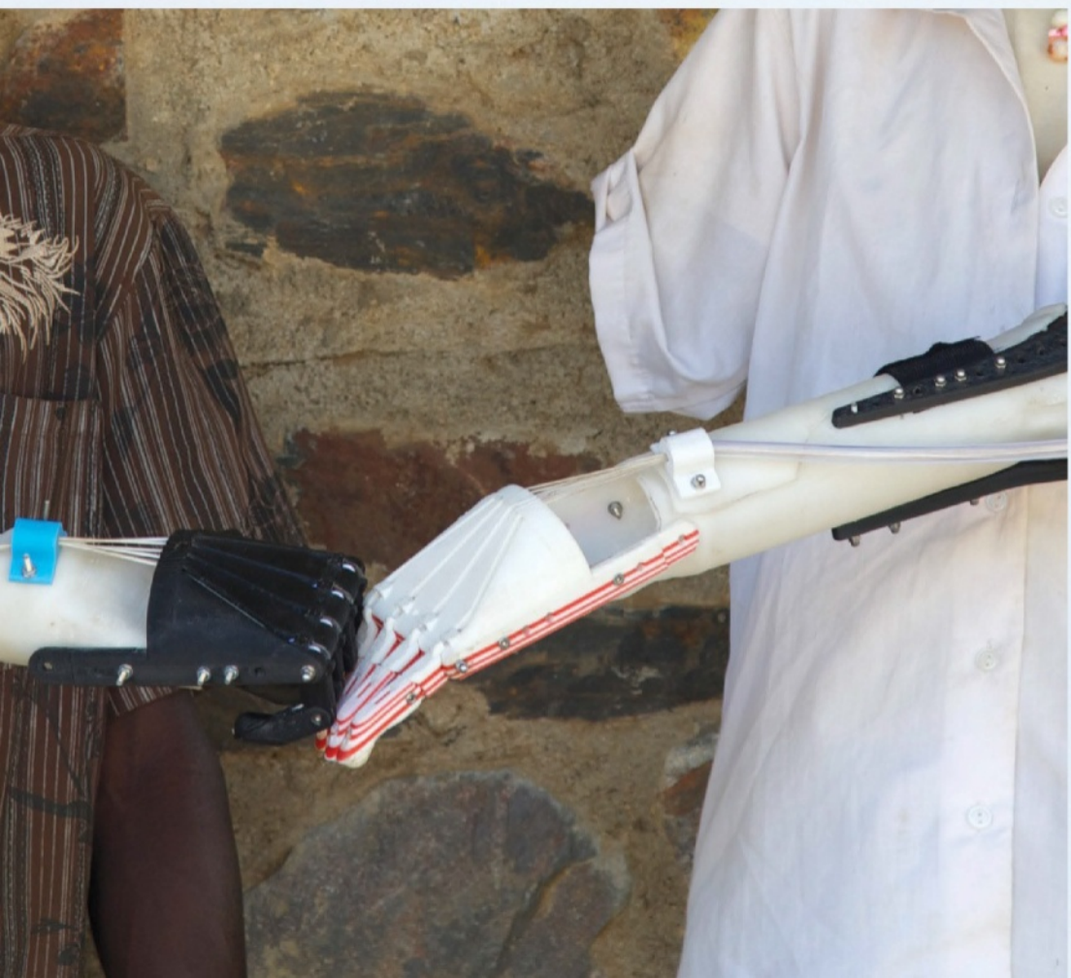
Dr Andrew Dawood, dental implant lead at Dawood & Tanner and specialist in prosthodontics and periodontics, knows these advantages better than most – he's been using 3D printing in dental implant treatments at his London practice since 1999. "I can not contemplate medicine and dentistry without 3D imaging," Dr Dawood states. "Having a 3D printer is only a part of the battle though. There is no point in having the hardware if you don't have access to the design talent and software." Considered a pioneer in the field, Dr Dawood has used 3D printing for a number of major developments, such as during the planning stages of reconstructive surgery for a patient who had lost his jaw, teeth and gums following a shotgun injury during a robbery. The surgery was the first of its kind and by using 3D printing to create a replica of the patient's jaw before the surgery, everything, from the bone graft to be taken from the patient's shoulder to the position of replacement teeth, could be extensively pre-planned beforehand, greatly reducing surgery time and risk.

Perhaps the most famous example of Dr Dawood's work, however, is with Eric Moger, a man left disfigured after emergency surgery to remove a tennis ball-sized tumour growing beneath the skin on his face. As traditional reconstructive surgery was not an option due to the chemotherapy and radiotherapy Moger was receiving, 3D software was used to model the contours of a facial and oral prosthesis that could be used to restore the shape of his face. This model was then 3D printed along with implants to anchor the prosthesis in place.

"3D printing and scanning helped us to streamline treatment, making it faster and less invasive, even enabling us to carry out multiple procedures in a single step instead of many," explains Dawood. "I am pleased that this work has highlighted the issues faced by patients with these problems – patients who otherwise appear to receive little attention and can feel unable to leave their homes. Mr Moger is certainly an inspirational individual." Following the treatment, Moger was able to ingest food and water regularly for the first time since he had undergone the initial surgery.

Medical 3D printing isn't based just around external work, however. "If someone gets in a car accident or develops a tumour, sometimes they essentially treat that by taking a large chunk of your skull," begins CEO of Oxford Performance Materials, Scott DeFelice. "However, if they do that, sometimes they try to put it back in but it just ends up not living." Like Dr Dawood and the rest of the team behind Eric Moger's incredible transformation, DeFelice also uses 3D printing to help patients with defects – in this case, by 3D printing a replacement bone: a piece of their skull. Originally, the company had started doing business by selling a proprietary polymer that was structurally similar to bone. Then, in the mid-2000s, DeFelice came across an article from a surgeon discussing the huge advantages 3D printing would offer with implantable materials.

"I went to our technical director and I asked whether we could simply print our stuff. That's how we started," continues DeFelice. "When we first came to 3D printing, people would be taking a big chunk of plastic, aluminium or titanium and machining it. You'd end up with things that didn't quite fit right and you couldn't even make



How 3D printing will save your life

something that was that complex, or it would take very long or be too expensive. All of a sudden, 3D printing comes along and we can get a CAT scan for a patient, design it to fit right into that person's defect, print it up with a bunch of other implants every week and ship it to the customer within five days of the order." With their new 3D printed material called OsteoFab, Oxford Performance Materials has now been working on designing custom-fit replacement skulls for critical surgical procedures all over the world, including a surgery where 75 per cent of a patient's skull was replaced. "We can make things that are really anatomically precise for a cost that's affordable and in a material that fits," tells DeFelice. "That wouldn't be possible without 3D printing."

Incredibly, even something as seemingly irreplaceable as human skin could soon be 3D printed. A few years ago, James Yoo, professor at the Wake Forest Institute for Regenerative Medicine, began designing a printer potentially capable of bioprinting skin directly onto a patient in need, such as a burn victim. The printer, which is now reportedly set to be used in clinical trials within three to four years, could completely change the lives of those with wounds that would not heal well, or those with a supply of skin too limited for a graft that needs to be taken from other areas of their body. Yoo has also been working on developing another printer – a hybrid printer that could print implantable fake human cartilage, something that would revolutionise medicine, considering doctors are unable to fully regenerate cartilage today. "The idea behind the hybrid system was to print a durable construct made of gels, which promote cell growth, as well as synthetic materials, which provide strength," he explains.

The engineered cartilage would not only be a faster, cheaper solution, it would also encourage cells to integrate into surrounding tissue, letting new cartilage fill the defect, making it even stronger than before. "After eight weeks of implantation, the constructs appeared to have developed the structures and properties that are typical of elastic cartilage, demonstrating their potential for insertion into a patient," Yoo reveals, telling us that though impressive, this is, in fact, just the beginning of the research the team has undertaken. "Based on this concept, we have since developed a more sophisticated robotic 3D system that has been used to print cells such as muscle, cartilage and kidney."

+ PRINTING ORGANS

"Basically, printing technology enables us to scale up the production of engineered organs," explains Anthony Atala, director at the Wake Forest Institute. Though even he agrees that it sounds like something from science fiction, Atala is a firm believer in the fact that 3D printing complex organs will truly become a reality, though not for several decades. "It enables a personalised cure by using data from a patient's CT scans to actually design a replacement organ or tissue," he tells, us explaining that the technology would not only enable the precise placement of each cell, but because bioprinted organs could be made using the patients' own stem cells or biopsies, the organs would not be rejected by their immune systems.

If this technology could be fully realised, 3D printing human organs would be responsible for saving thousands of lives a year – eighteen people die waiting for an organ transplant every day and many others lose their lives before they even get onto a transplant list. With an ever-growing population, the number of people who need a transplant increases every year.

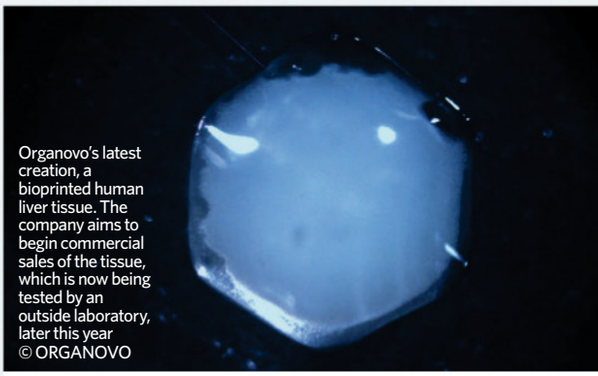
For Organovo, the first publicly traded bioprinting company, solving this problem is the ultimate aim. "Our goal is to recapitulate native biology," affirms Mike Renard, executive vice president of commercial operations. "We want to make a difference in people's lives, to restore and regenerate health." Using their own NovoGen MMX bioprinter, the team develops bio-inks, or multi-cellular mixtures created from cells of any source, which are then dispensed from the printer layer by layer with the help of a computer-programmed script. After being incubated for 48 hours or more to allow it to mature, the tissue is then ready. If everything goes according to plan, it will achieve the form and function of the real living version of itself. Bio-inert hydrogel components may even be utilised like classic 3D printing supports for the tissues as they are built up vertically to ensure correct three-dimensional shapes.

We can make things that are really anatomically precise for a cost that's affordable and in a material that fits

Scott DeFelice, CEO of Oxford Performance Materials

In 2012, Organovo partnered with Autodesk Research to develop 3D bioprinting software to aid the process. Two years later, months ahead of the intended April 2014 release, the team announced the delivery of the company's first future product – slivers of functional bioprinted liver – to an external lab for experimentation. Later this year, Organovo aims to begin commercial sales.

"The intended use is for medical research and drug discovery," continues Renard. "It can give scientists in the laboratory a new model to conduct testing and analysis." In fact, using the bioprinted liver tissue to test how the real organ could process and react to new drugs will greatly improve the speed, predictability and expense of drug discovery and development, which on average costs 1.2 billion dollars and takes twelve years to develop with methods used today. Of course, this is also a major step towards Organovo's long-term goal of producing full organs. With the technology they've developed, printing an average-sized liver would



Organovo's latest creation, a bioprinted human liver tissue. The company aims to begin commercial sales of the tissue, which is now being tested by an outside laboratory, later this year
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The Novogen MMX Bioprinter®
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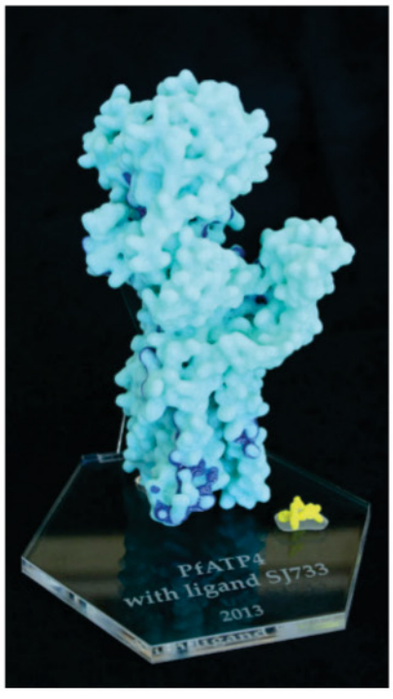
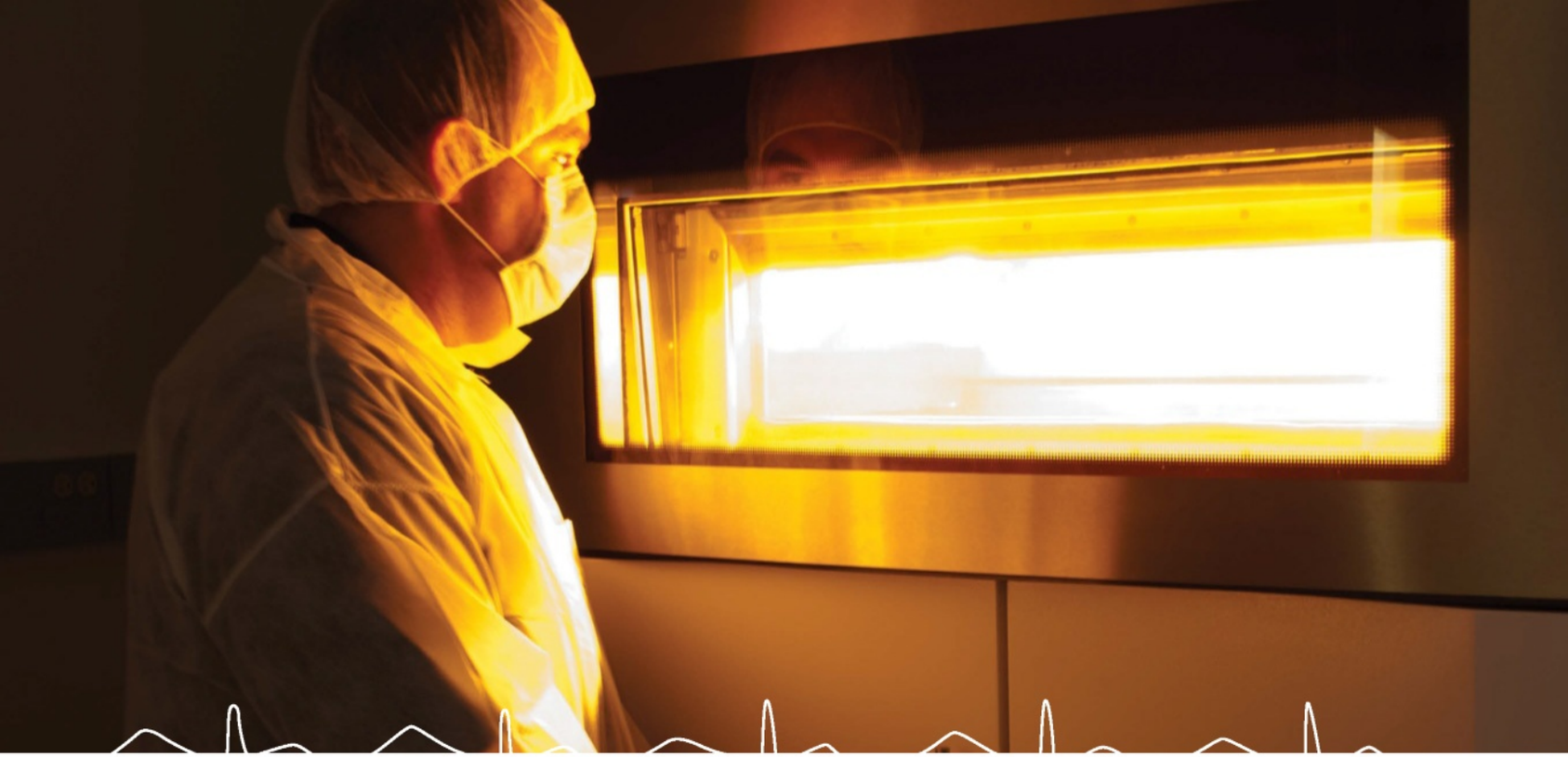
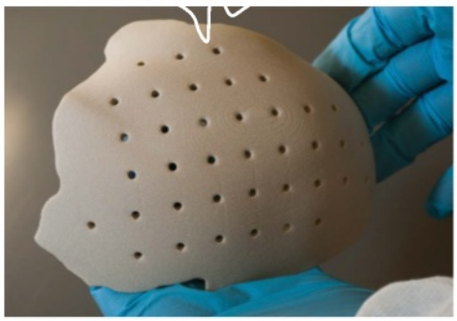
Printers in the lab

Already, printers are enabling researchers to print the exact tools they need very cheaply compared with older methods, and for biochemist Joseph DeRisi, allowing scientists to learn CAD and 3D printing for their work is crucial. "3D printing is now an integral part of our everyday laboratory work," he explains. "We use Solidworks and Autocad within the lab. Learning CAD is fine for scientists – it's a lot easier than biochemistry! We make parts for pretty much everything you can imagine, everything from custom slides on microscopes, to microscope parts and adaptors." The files for the equipment produced by DeRisi and the scientists at the lab are currently available to download at **www.tinyurl.com/3DADeRisiLab**.



Protein-drug interactions made tangible by 3D printing: model rendered in Chimera, printed on Dimension's uPrint





The process of creating a patient-specific cranial implant device from OsteoFab, including the printer while lasering and the breakout of the skull implant. The medical devices are derived directly from the patient's CT Scan or MRI file for a perfect anatomical fit, and can be shipped to the customer within five days of the order being placed

Emma using the 3D printed WREX to move her arms. "The only hindrance I can see is who owns the rights to things like this," says Sample. "We've been approached ever since the original WREX video went viral and I wouldn't be surprised if there were people out there with models of it to download on their open-source websites."

Whitney Sample crafting a device. 3D printing offered the advantage of being able to go from a unique design idea to prototype very quickly, and enabled the team to easily swap out individual components as needed

Improving surgery

Doctors in Belgium have already saved hours in traditional facial surgical procedures by scanning the contours of patients' bones, then 3D printing a full-size model that they can use as a surgical guide. As the model is such an exact replica of the patient, surgeons can also use it to pre-plan, shaping the metal inserts that fit along residual bone during reconstructive surgery, removing the need for trial and error during surgery itself. Impressively, this is all done using paper 3D printing. "Paper 3D printing technology is the only ecological technology on the market, involving only a biodegradable laminated paper and eco-friendly adhesive from Mcor Technologies," notes oral and maxillofacial surgeon professor Raphael Olszewski. Both affordable and biologically friendly, it's a technique that could potentially be a powerful future alternative to the expensive neuro-navigation systems that currently ensure accuracy in surgery.

One day, we may even think about programming chemistry using a chemical HTML and standardised scripts, but it's important now to start debating just how safe it would be

Professor Lee Cronin, Regius chair of chemistry

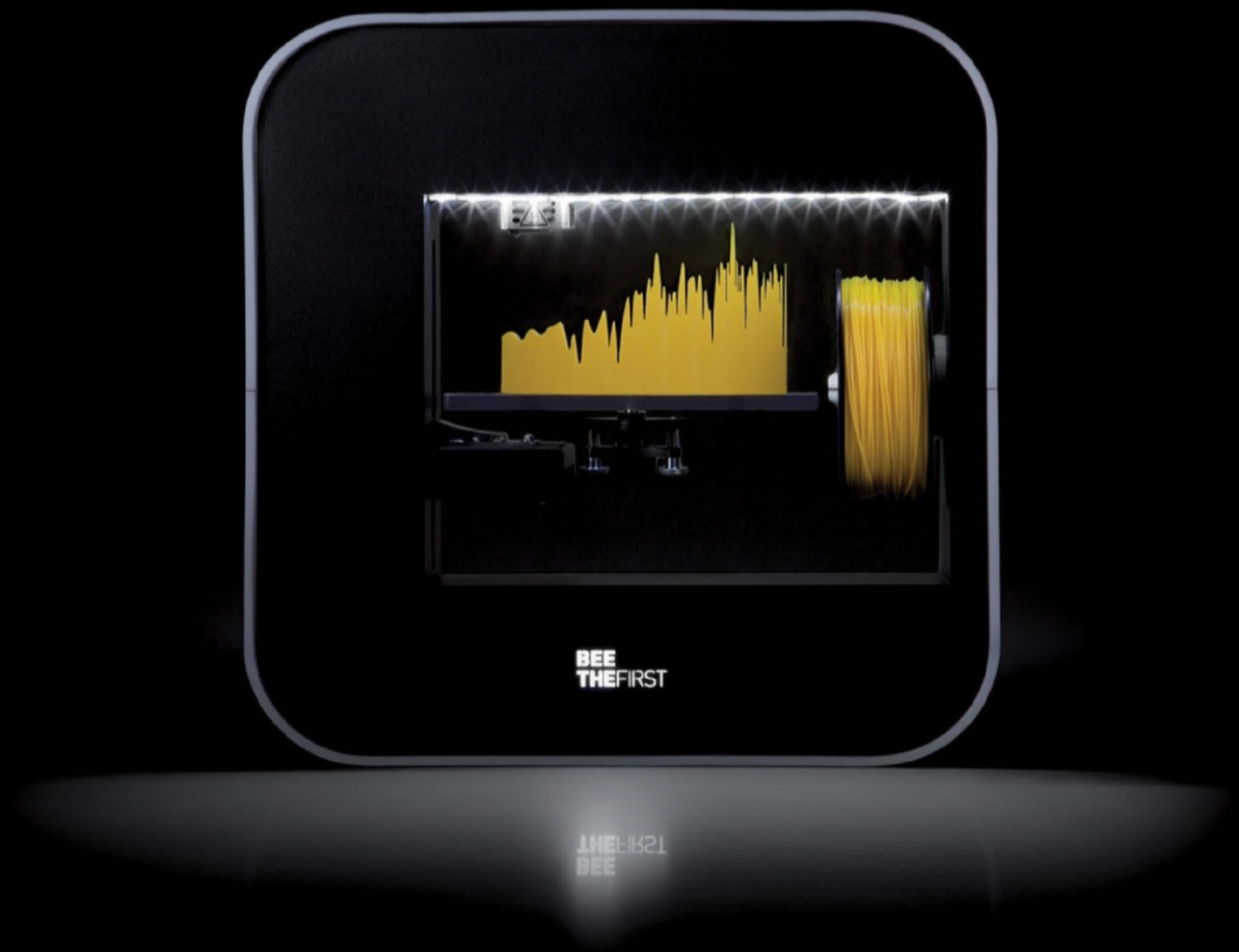
only take ten days. The team is working towards prints as fast as three hours. It's a revolutionary concept, and one that could truly change the world.

Meanwhile, for professor Lee Cronin, Regius chair of chemistry at the University of Glasgow, 3D printers could one day go even further. They could be used to perform chemical reactions to make new molecules for applications such drug discovery, or even one day, the possibility of a personal medicine fabricator, which could be used to print personal medicines at home. "What it actually should be called," specifies Cronin, "is a matter manipulator, because you have to put stuff in and you alter that stuff, there's no magic to it, just chemistry." The idea first came to him after an architecture conference a few years ago, where he heard a presentation on 3D printing for new architectural designs. Cronin then thought it might be interesting to use the technology to work on chemical reactions in the lab; he and his team have begun to both modify existing printers as well as creating their own to do just that.

Their printers essentially have two roles. The first is as a classic 3D printer for plastic objects – the beakers and test tubes needed for the reaction. The second involves the printer using its X, Y and Z-axis functionality not to print plastics, but to handle liquids, moving chemicals into the plastic devices created. In principle, this would mean that as long as you knew what inputs you have used and the order in which they are mixed, it would be possible for people to simply share that code with each other to be able to reproduce the same molecules. "Say you have two labs, one in Australia and one in America," he explains, "and the one in Australia has just learned to make a new molecule which is really tricky to make. If there was a robotic system that understood all this code and they gave that code to the group in the US, maybe the group in the US could reproduce that molecule much more effectively than other routes such as trial and error." Eventually, this could mean that being able to print something such as a drug will be possible in the next 20 to 30 years.

"The other thing to bear in mind," Cronin adds, "is that one day, if this does catch on and is useful – not even as something in your house but for when you go to a drugstore – is that a lot of drugs are not made forever. When an old drug is replaced by a newer drug, which is presumably more expensive, then you don't get access to the other one. What this could mean is that people could access 'out of print' drugs, which may be a way it can become economically more viable to use these machines."

Ultimately, Cronin is the first to admit what a huge undertaking all of this is, but that won't stop the team from aiming for proof of principle to demonstrate what is possible and to start a serious discussion. "One day, we may even think about programming chemistry using a chemical HTML and standardised scripts, but it's important now to start debating just how safe it would be, the consequences of potential misuse and the new economic models that may emerge from the ability to be able to fabricate your own things," he concludes. "This is not science fiction at all. It's going to happen."



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Incredible 3D artists take us behind their artwork

Artist info

Dennis Allain

Website www.dennisallain.com
Country USA
Software used Cinema 4D R13 and Photoshop
Bio Dennis has been creating art for nearly three decades. In 2004 he opened his own design studio

Irongore 2010

The full title of this piece is *Irongore vs. The Invaders from Space*. In January 2010, CGTalk sponsored a design and illustration competition entitled CGSociety Challenge XXV – B-Movie. This was a creative task to imagine a classic B-movie. Since I've always been a big fan of science fiction and horror, I decided to take part. Entering a themed competition from time to time gives me the opportunity to illustrate a subject matter that I don't typically get to experiment with in my professional life.

"When I paint in Photoshop, I bring the CINEMA 4D base rendering into Photoshop CS4 and start by spreading washes of colour for the sky and ground areas. Starting with bigger areas of the painting helps build my confidence and establish my colour palette"

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Step by step

Easy-to-follow guides take you from concept to the final render

Artist info

Caleb Nefzen
(David Molina)

Personal portfolio site www.invoke3d.com
Country Colombia
Software used ZBrush, Maya, UVLayout, KeyShot, Photoshop
Expertise All levels of character modelling, sculpting, texturing and rendering

Sharpen your ZBrush skills

Ninja 2014

> Here we will discuss how to make convincing battle-worn characters, using both DynaMesh and MicroMesh to create wear and tear in fabric

Caleb Nefzen is a CG artist who works in character creation, from conception through sculpting, texturing and rendering

In this tutorial we're going to take a look at the creation process behind the ninja you see leaping out of these two pages.

If you've used ZBrush before and have a solid grasp of the fundamentals, then this tutorial is for you. We will consider how to start work on a character such as our ninja, how to define the main shapes, how to sculpt hair and how to finalise the pose.

However, the main focus here will be how to create battle damage in a high-resolution sculpt, such as the tears and rips in fabric that communicate that a hard-fought battle has taken place. We will consider two effective ways of creating wear and tear in a sculpture without the need for a great deal of geometry, taking advantage of DynaMesh and also using MicroMesh for quick, simple and relatively easy results.

In addition to this we will cover some useful hints for making characters. By the end you will be well equipped for making dynamic, exciting 3D character stills.

Learn how to

- ☑ Combine MicroMesh parts with high geo
- ☑ Convert MicroMesh to geo for wear and tear
- ☑ Create MicroMesh geo
- ☑ Use DynaMesh
- ☑ Create dynamic folds
- ☑ Use the CurveSurface brush

With the Disc

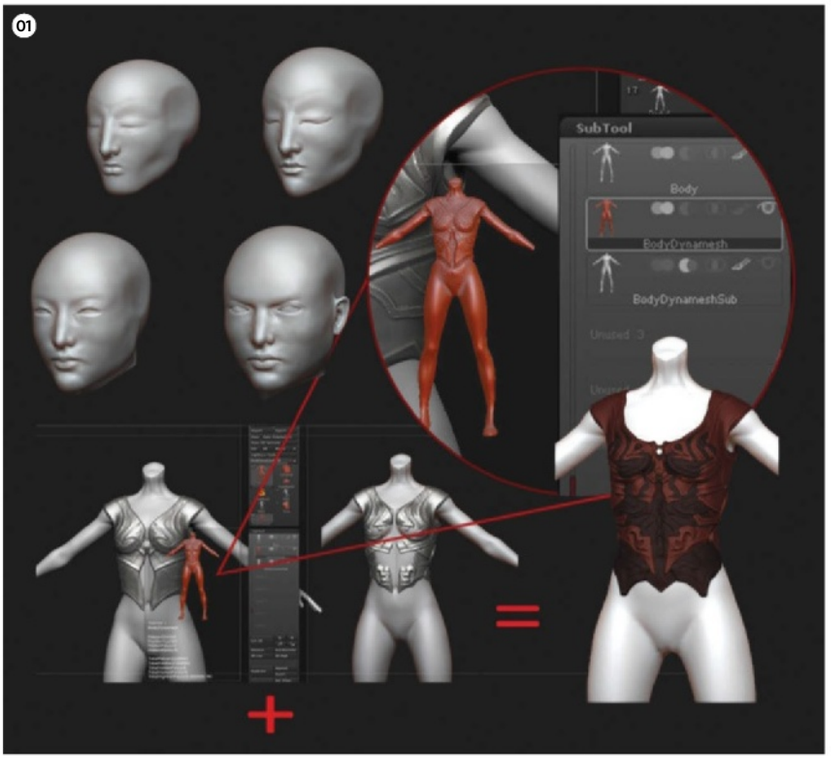
Tutorial files:
- Tutorial screenshots

Bring your character to life

Begin the initial sculpt and pose your character

01 Use DynaMesh for the head and armour You can choose how you would like to start, either from a base sphere or from a base mesh, although a sphere offers more freedom. It's always a good idea to use reference images when sculpting the head and body, so long as they're for inspiration rather than direct reference. For the armour, duplicate the body previously created, setting the Inflate value to -1 and calling it bodyDynaMesh. Duplicate this again, calling it bodyDynaMeshSubstract. Work the armour with the bodyDynaMesh. Once finished, apply DynaMesh Substract and select Merge Down to leave it ready for retopology.

02 Add FiberMesh for hair Once the retopology is complete, either manually or by using the ZRemesher process, we can create different polygroups over the scalp. This gives us increased control when creating the FiberMesh. Once created, hide the rest of the head, add shadows to those polygroups and create the hair. Choose the sharpest option according to the character. For brushing the hair you can use GroomHairLong or GroomHairShort, although I prefer GroomHairToss and the Move tool with a Z Intensity set to Low. Testing new tools is the best way to improve your skills.



03 Find a dynamic pose For the posture, create a rig with ZSpheres and Transpose Master. The rig with ZSpheres gives excellent control for general body contortion, although it does not give the same support over the other SubTools in the model. Therefore, you must create the SubTools at the beginning so that they won't lose their shape within the rig. Once you're satisfied with the ninja's pose you can finish the rig, then use Transpose Master to refine and tweak the posture to get it looking right. By using Active Symmetry and Use Posable Symmetry, you can finish the details while adding the rest of SubTools to the model.

Use instinct

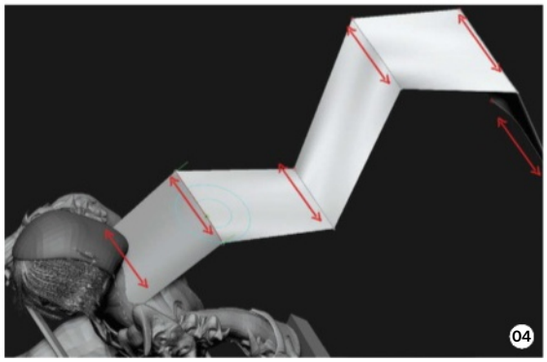
There is a quote in the film *The Last Samurai* about the need to relax and let instinct take over, which I always bear this in mind when I am working. Sometimes we overthink certain things and this blocks out any other thoughts. In order to let our instincts take over, we need to clear our heads and let our minds just go blank. It can be quite hard to achieve at first, but with practice it gets easier. By clearing your mind, you are enabling yourself to work instinctively. Remember, there are always several ways to achieve what you want, but it's up to you to work out which is best.

Concept

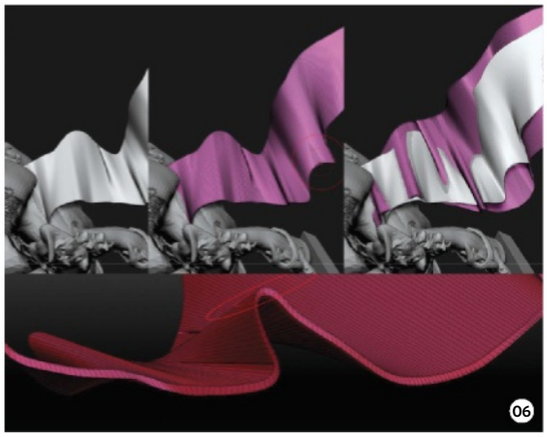
This project is based on the depiction of dynamics, with a contrast between the character's freedom of movement and the look in her eyes, which are deep and fixated on the viewer. It's all about expressing feeling without words.

Create wear and tear

Use DynaMesh and MicroMesh to achieve a tattered look

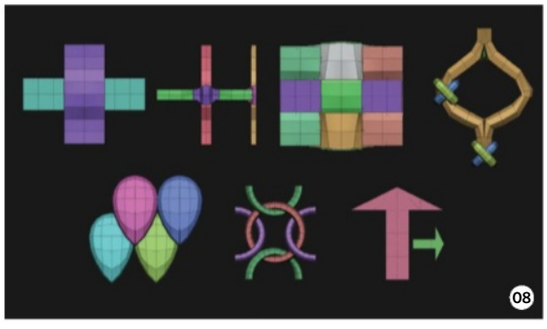


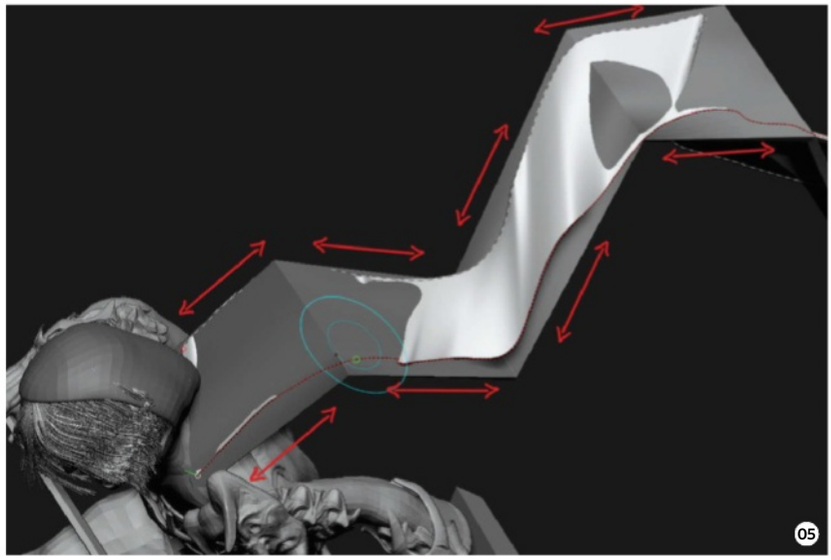
04 Create the cape with the CurveSurface brush Making use of the CurveSurface brush, create one-by-one vertical lines to generate a rough guide of the shape and direction that we want to give to the cape. Always make appropriate use of the camera, since it will help you to generate the lines without difficulty. Don't worry if you don't get the shape you want at the start – remember that this is only the base for the rest of the cape.



Using MicroMesh

MicroMesh is a BPR render feature that allows you to replace a FiberMesh object's fibers or the individual polygons of an object with another 3D model. In other words, a model's fibers or separate polygons are rendered as if they were actually instances of the selected 3D model. It's great for finer details like chainmail or threads.

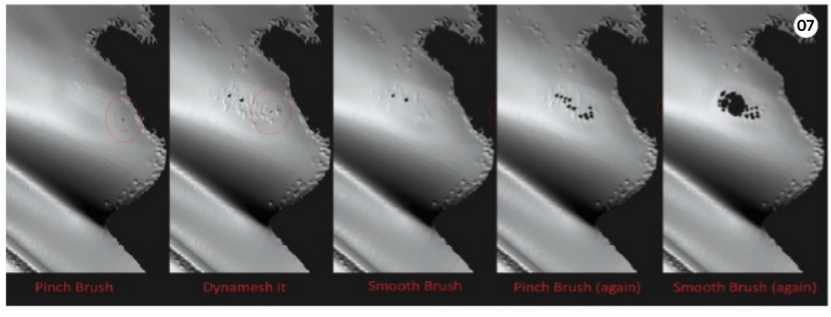




05 Add definition with the CurveSurface brush Having made good use of the CurveSurface brush to generate a guide mesh, use it again to draw a horizontal and parallel line, covering up the guide mesh. Next, use a relatively low Draw size, which will help you to generate the suitable thickness within the layer.

06 Create dynamic folds Once you have defined the shape of the cape, exit from CurveSurface brush and start manipulating this geometry with the Move brush. Due to this geometry having only vertical edges, it is very easy to generate double folds on the fabric. Make changes in the Brightness level of the scene so it's easier to see shape and movement, as well a variation of Z Intensity settings for generating more variety in the folds. Always make sure you're controlling and reducing distortion at much as possible – since this geometry will become DynaMesh, we don't want to lose definition in the folds of the cape itself.

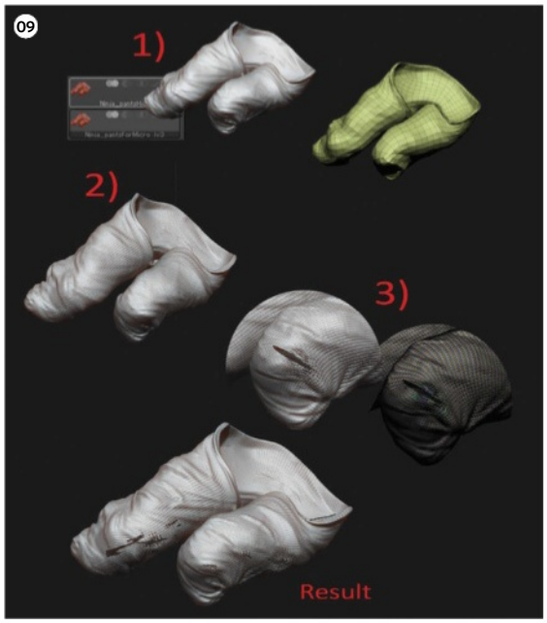
07 Start creating tears Once the big folds have been defined, take this geometry to DynaMesh with medium resolution. Using the Pinch brush and, making sure that BackFaceMask is deactivated, use it on the parts that you wish to tear up. Having done that, DynaMesh it. You will see all the marks where a merge has occurred in the geometry. Next, use a Smooth brush and DynaMesh it again. Following this, the holes will be wider, so keep repeating this process until you achieve the effect you desire. With the Standard, Dam Standard and Smooth Directional you can sculpt fine details and additional folds.

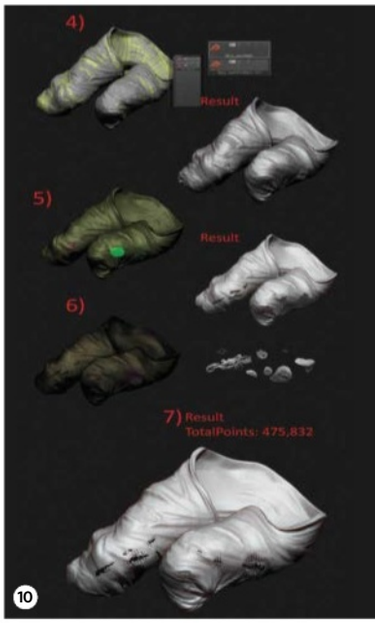


08 Utilise various MicroMesh tools In a new ZTool, take the grid as a space reference and the top view without perspective. Make use of planes to create basic geometry to emulate threads. Use different references to create several pieces, which you can use in this model and future ones. You should leave one polygroup for each plane, otherwise you won't achieve the desired effect. It's important to make sure that you make proper use of the tools that ZBrush offers, such as Symmetry, Mirror, or Mirror and Weld.

09 Utilise MicroMesh for wear and tear Duplicate the trousers, one being called PantsHigh, and the other PantsMicroMesh. Apply MicroMesh to the latter. If you think that there's a problem with the co-ordinates, select Align Edges, which will line up the vertices in the same direction. Next, apply Convert BPR to Geo, then generate the geometry. Given that each MicroMesh has a different polygroup, make sure that Mask By Polygroups is set to 100 and use the Move tool. By doing so you will skip the exhausting process of moving and eliminating some of the polygons.

10 MicroMesh parts with high geo Knowing that PantsMicroMesh will be extremely heavy due to the density of the geometry, we must project its details onto PantsHigh and apply Decimation Master to it. Then, with the SelectLasso brush, we will convert it into polygroups and eliminate the PantsHigh parts, giving room for the worn effect of PantsMicroMesh. We can do the same with PantsMicroMesh, except here we will eliminate the large trouser part, leaving only the worn areas, which will match perfectly with projected details on PantsHigh. Select Merge Visible and it will give you a SubTool with the worn effects.





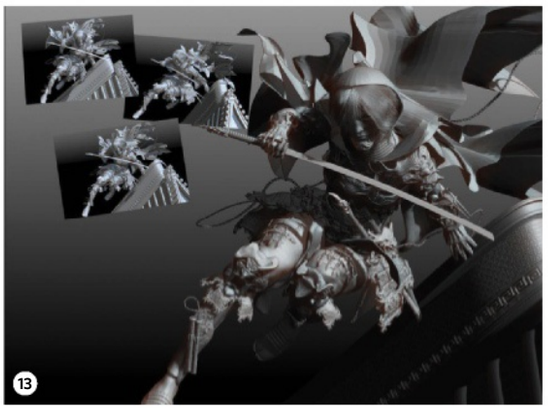
Work on the details

Build up details to tell the character's story

11 Add battle details Certain Alphas or customs Alphas can improve the quality of your work. However, I don't think that it's good to become overly confident with such automatic tools – sometimes sculpting freehand gives you better results, even if it's more arduous. Attempt to tell the story through your sculpture – in this case, she's had difficult moments while working on her mission, so it's important to show certain details such as scars and burns.

12 Texture damage and wounds A crucial part is the work on textures. Strive to capture the situation of the character – how, where and who they are. In this project the injuries are important, but be careful not overdo this by being too focused on gore. Use the Mask By Cavity function to give depth, but remember that the use of Alphas and the range on RGB Intensity offer much more, especially if you're working with monochromatic tones.

13 Alternate your view Sometimes, after spending a long time looking at your image with certain lighting and camera positions, you can become detached from your image. I would advise that you constantly consider your work from multiple angles, and to take plenty of breaks, or to work on another project for a while. This will let you see your work objectively, plus it will give you the opportunity to think of new ideas.

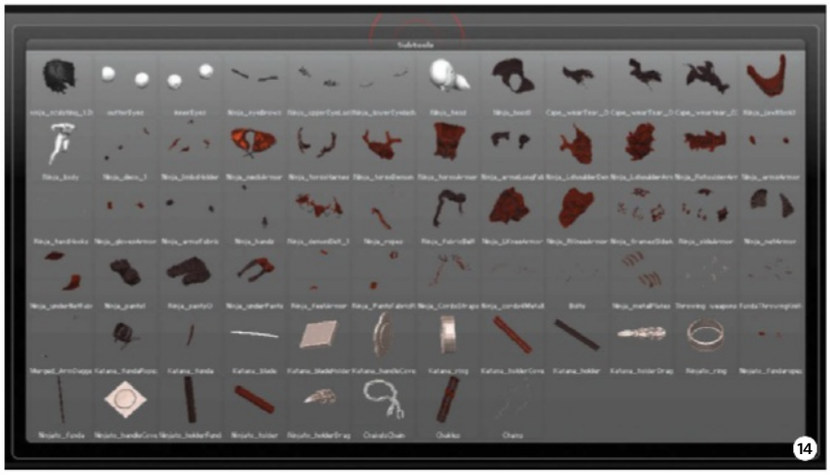


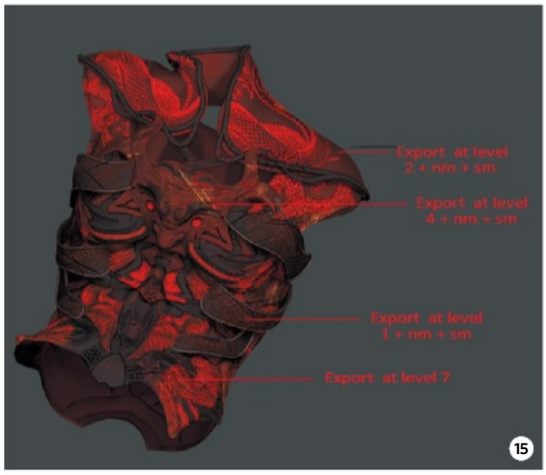
Create to destroy

Sometimes we might create things that we eventually must hide, distort, or even destroy. Don't feel bad about it – by manipulating certain elements of your scene, you're ultimately adding to the final effect and composition. Sometimes less is more. It takes time to realise what adds to a scene and what isn't quite working.

Finalise the composition

Clean up your scene and add lighting





14 Clean up the scene in ZBrush Work the order of the SubTools according to the sequence of your scene. Generally the hair is the first in the list, followed by the eyebrows, eyelashes, eyes and head. By tidying up your elements like this, it will make it easier to find objects, so if you're looking for a belt, you'll know that it's located in the middle of the list. The last things in this list should be things like knives and chains. Name each SubTool – this will not only help you in ZBrush, but in all the other programs that you choose to use.

15 Optimise for KeyShot It's well-known that KeyShot is a powerful tool, but this does not mean that we should abuse it. Knowing how to identify which level of geometry is best for importing to KeyShot and knowing that it will work well with the Normal map is of paramount importance, and will result in a better final image.

16 Add lights and materials By now we need to start adding material and lighting into the scene to make it seem more realistic. So far, everything is a rather bland, basic grey material, so texture and lights need to be added to avoid any confusion. Start by adding a light to the scene, then add subsurface scattering to your model – this will enable you to see the relationship between the lights and materials. Create volume, manipulating the play between light and shadow. Don't abuse the lighting presets in KeyShot, but don't just settle for them – you can always make your own HDR images and produce your own light pins for the model.

17 Achieve the final composition Always remember that a render will need various corrections to make for a better composition. Post-processing should be used to adjust and enhance the brightness, contrast and saturation of the image. However, always try to remain faithful to your original ideas for the scene. Sometimes a piece can be overworked and ruined after multiple edits in the post-processing of the composition. That said, ultimately it's up to the artist to decide whether too much post-production has been added or not.

Final thoughts

When starting a new project, be patient. Sometimes it takes time to appreciate what you're doing, or to get to a stage where your work starts to match your initial concept. If things start to go wrong, don't be lazy and don't give in. If you do make mistakes, you don't always have to get rid of them, as they can often provide material for future creations. Just stick with it, remember you goals, and you'll end up with results to be proud of.

• **DID YOU KNOW?** • All tutorial files can also be downloaded from: **www.3dartistonline.com/files**

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Step by step
Easy-to-follow guides take you from concept to the final render

Artist info

Paul Pepera
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Country USA
Software used 3ds Max, V-Ray, Photoshop
Expertise Environment, vehicle and weapon design as well as hard surface modelling

Create a convincing spacecraft design

Heavy Space Tug (HST) 200F 2014

"The intention behind this space tug image was to design a spacecraft concept that felt futuristic and yet also believably functional"

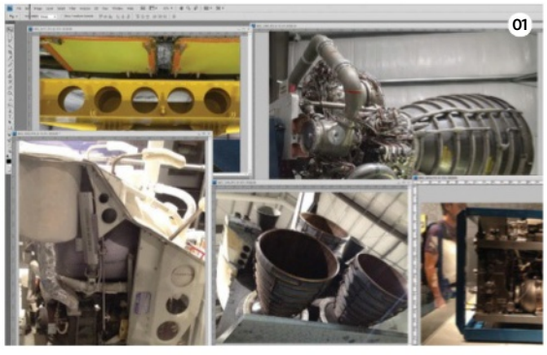
Paul Pepera is a 3D artist working in the video game industry

In this tutorial I will provide an overview of my design process when modelling a highly detailed and functional sci-fi spacecraft. I hope to cover core skills such as polygonal and spline modelling, renders and presentation. As well as this, I will cover more abstract skills, such as utilising real-world reference images to generate realistic and functional design elements and using artistic principles to achieve a visually pleasing design. I also hope to cover some things to avoid, such as perpetuating clichés.

The ultimate goal of this project is to produce a highly detailed rendering of a design that is grounded in reality, yet fantastic enough to stimulate the viewer's imagination.

Design an initial prototype

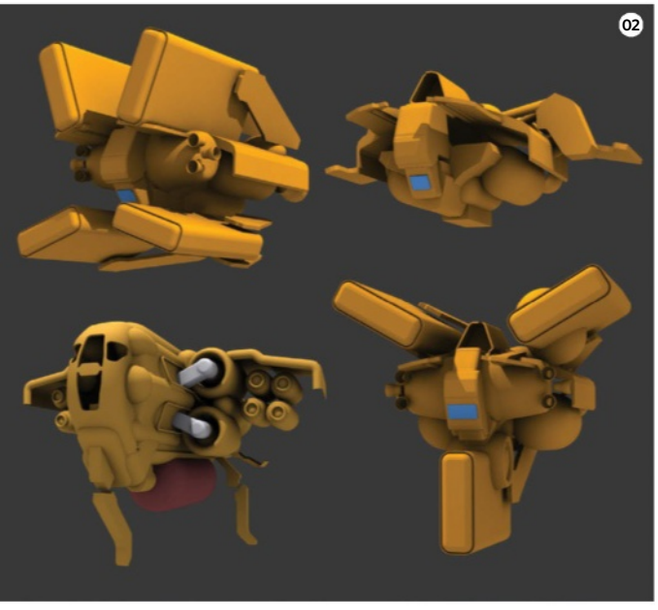
Identify the design framework and visual language

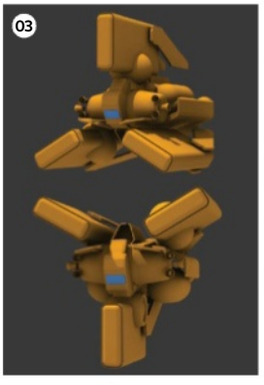


01 Gather your references Before starting on any modelling, it is a good idea to gather all the reference material you think you'll need to satisfy the needs of the model. Soviet spacecraft design, NASA probes, construction vehicles, tug boats, submarines – they all have relevant design elements that could be creatively incorporated into the work. Utilising these elements in interesting ways is the linchpin of this process. Identify the most interesting elements and try to think of ways to incorporate them into your design. These photographs were taken during a visit to the Space Shuttle Endeavour exhibit in California, USA. I prefer to arrange the images in a collage that I can quickly reference while modelling.

Create a fictional framework

Along with establishing a visual framework, it is important to create a fictional framework for the design to live within. Think about the space the design occupies. What is its context? Establishing some sort of history for the model can help drive its design – in this case I've created a tug boat that moves larger ships.





02 Develop the concept Begin the 3D concepting process by blocking in the main shapes of the design. At this point, you need only focus on the basic shape. For reference, look at existing construction equipment and industrial machinery. In this particular instance, I thought the bottom-left design in the accompanying screenshot had some really interesting forms, but ultimately I decided to go for shapes that felt much more realistic and utilitarian. However, even though I didn't use this option I didn't discard the design. Remember that even at this early stage rejected concepts can be reused for later projects. A great idea – even if it's not relevant for the current project – is still a great idea, so it should be saved for further experimentation down the line.

03 Choose a design One of the requirements for this design was that the ship needed to look good in any directional rotation to take advantage of its zero-gravity environment. Out of the series of initial concept models I made, the three-winged, triangular design is the strongest. At this point, keep thinking of functionality and secondary details, such as the reaction control system (RCS) rockets on the front-side near the cockpit and the two large fuel tanks flanking the sides. Look at your model from different angles to identify the focal points – every viewing angle needs a strong focal point to ground the design.

Concept

This spacecraft has been conceived as an industrial tug boat, used to manoeuvre much larger craft in the space ports of the distant future. Many of the elements have been inspired by actual spacecraft and current industrial vehicle designs.

Learn how to

- ☑ Conceptualise in 3D
- ☑ Utilise hard surface modelling techniques
- ☑ Impart an implied sense of practical functionality
- ☑ Increase your efficiency when working with highly detailed models
- ☑ Avoid clichés

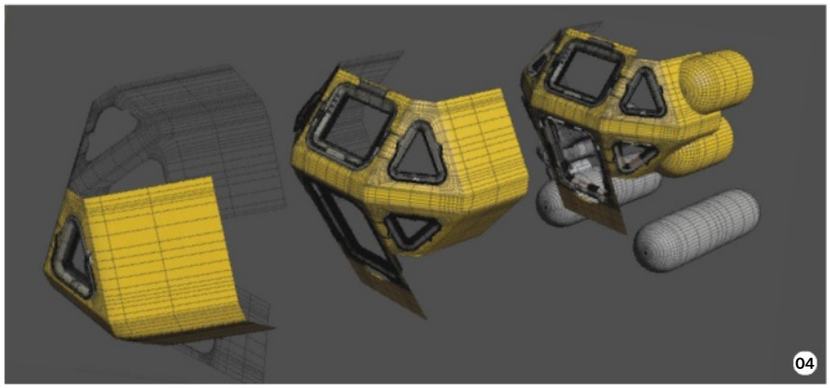
With the Disc

Tutorial files:

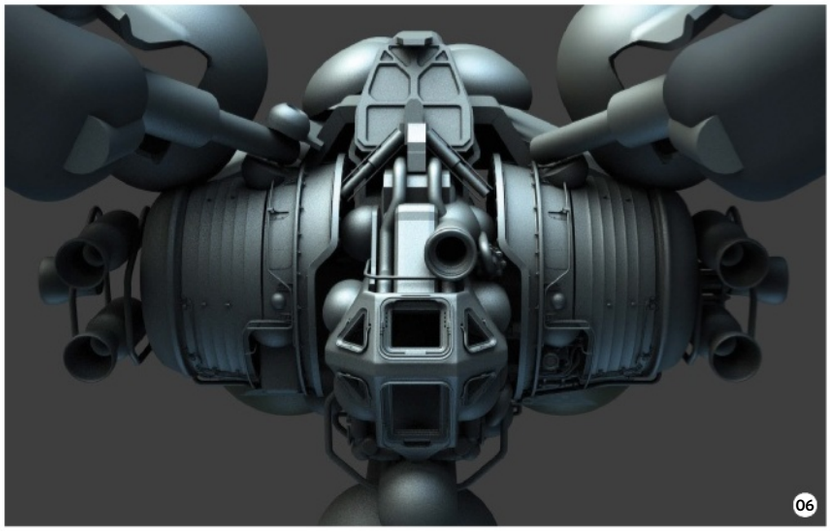
- Tutorial screenshots

Begin the modelling process

Start modelling the spacecraft based on your concept

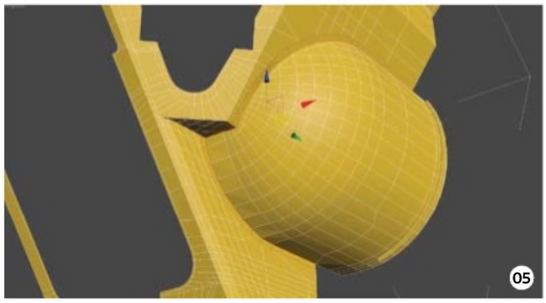


04 Start with the cockpit By now we have a pretty good idea of where the design is going. At this point, pick a key element and start fleshing it out with more detailed and refined modelling. The section chosen for this process is the cockpit area. It is one of the focal points of the design and serves to communicate the scale of the craft. In order to model the complex cutouts parallel to an axis, make a few instances of the cockpit mesh with each side facing a certain direction. This way we can easily model each side of the mesh without rotating it.



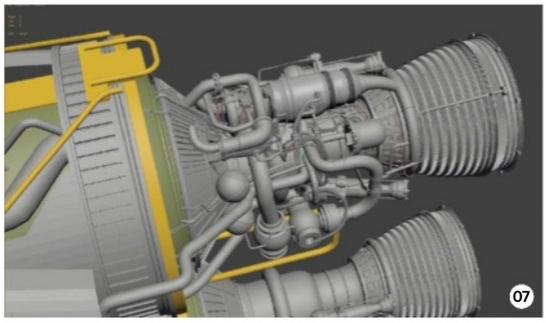
07 Add RCS rockets The RCS rockets are what enable the tug to move around in space. Considering the main usage of this spacecraft is to push and pull other, larger ships, it would seem that the main rocket engines should be located on the rear and front. We want the cockpit area to be flanked by four large rockets and the rear of the craft to have the two main propulsion engines. Start by pulling up images that you have collected of various rocket engines – I have a library of images like this I have built over the years, which is very handy for reference. I based these two main engines on Saturn IV boosters and Space Shuttle engines, and chose to make them some of the most intricately detailed parts of the model.

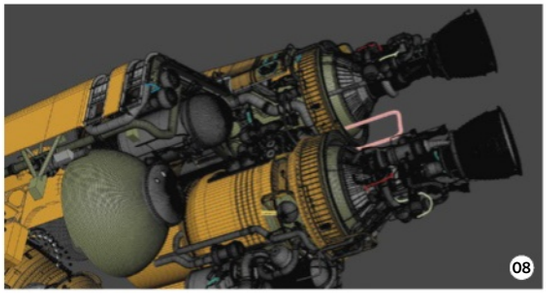
08 Imply functionality Remember to keep your details functional and deliberate – avoid ornamentation. To retain a functional aesthetic it is important to justify any element that is introduced into the design. If a person is going to take the time to view your work, then you should reward them with meaningful detail. Avoid typical sci-fi clichés, such as the random 45 degree angle. There is so much useful real-world reference available on the internet – even reference that is completely irrelevant to the subject matter can yield valuable design ideas. Never make up individual components from your imagination. Instead, let your imagination figure out how to creatively use real-world reference in interesting ways. If you are successful, your designs will feel grounded, even if they are inherently absurd.



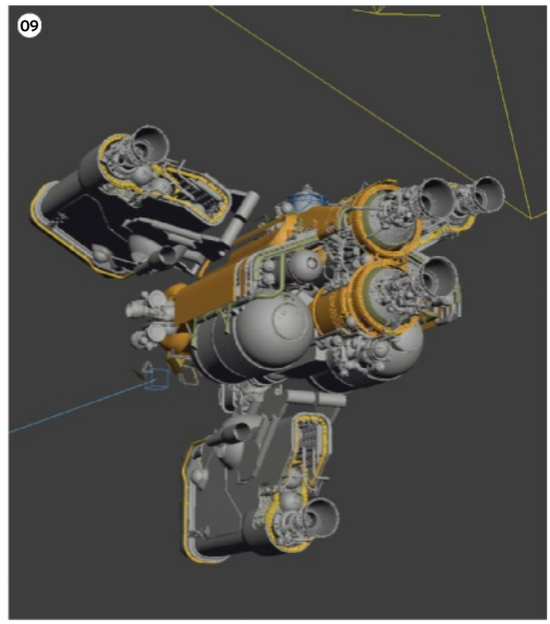
05 Model in the elements When modelling in complex forms it's important to use enough geometry to force the shapes. Using too few polygons can often result in unwanted artefacts due to the subdivision process, such as pinching and creasing along curved surfaces. In this example we want to intersect the capsule shape into the side of the cockpit. Ensure both shapes have enough geometry, so when it comes to cutting them together the resulting shapes are nicely integrated. My favourite tool in 3ds Max for this job is the Cut tool, so we can manually cut seams along the intersecting borders to the shapes. Use the Bridge tool to unify them, while controlling the topology. Along these intersecting junctions it's vital to keep the polygons quads as they will subdivide well.

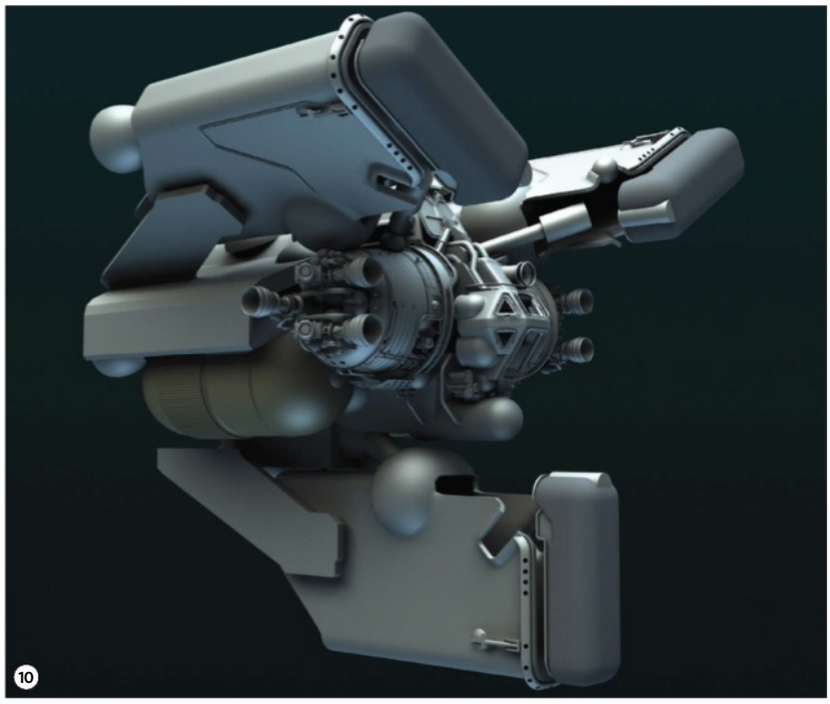
06 Work on the front The cockpit would be pressurised, enabling the pilot to work in the vehicle without needing to wear a pressure suit. To help communicate this, make sure that the windows of the cockpit look as if they were designed to retain the pressurised environment of the interior. Look at window designs of both the ISS and submersibles, making sure to keep the framing thick. Place handrails around the windows to help astronauts that need to do extravehicular maintenance. Small details like this help to emphasise the concept of functionality.





09 Make regular renders Every so often during the modelling process, do renders for self-critique and course correction. It is important to do these renders to see how the design is coming along in the context of a proper lighting setup and with shadows and Ambient Occlusion. This enables you to identify which areas need more work and which areas can be considered finished. For this particular model I chose V-Ray as the renderer. Like a chef tasting their food, or a musician listening to their own music while composing, you will need to step back to look at your work. Become the viewer.





10 Develop the bumper wings The three bumper wings flanking the main superstructure of the tug are the most identifiable elements of the design. For my design, I wanted to make sure that the front bumpers would essentially be giant blocks of rubber scratched and scraped from years of usage. For this, look at real life tugboat bumpers, such as tyres, and try to base the spacecraft bumpers on that type of look. In my project, I initially experimented with several tiny rubber pads on the front, but quickly discarded them when it became obvious they would be adding too much visual noise. We want these bumpers to be a nice, simple contrast to the orange metal finish that will cover the rest of the ship.

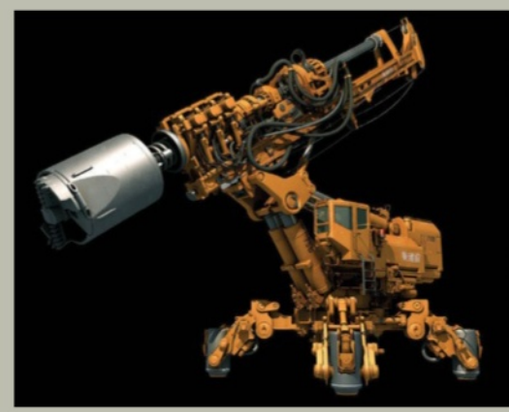
Spatial composition

See how the eye travels across the forms. Having a good ratio of large to small forms will help achieve desired paths of eye movement. Like a painting, you want to compose the design so that the focal points are emphasised. Adding functional details adds a nice payoff to leading the eye to certain areas on the model.

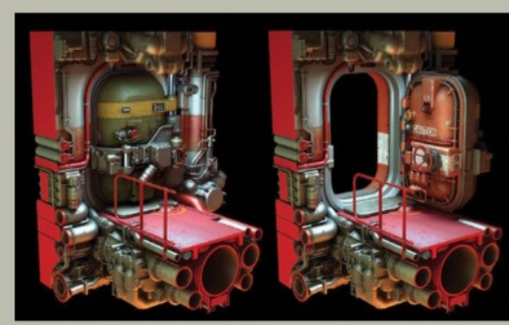
Artist Showcase

Paul Pepera

I'm currently working at Valve Software as an artist. I have previously worked at Microsoft's 343 Industries on *Halo 4* and at id Software on the *DOOM* franchise. I have also contributed to other games in a freelance capacity, such as Tripwire Interactive's *Red Orchestra* series. In my spare time I enjoy photography, hockey, poker, drawing and reading about history.

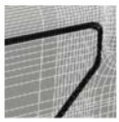


Rotary Drilling Machine **3ds Max (2012)**
A mech-styled rotary drilling machine concept, which was created in 3ds Max as a personal design exercise.



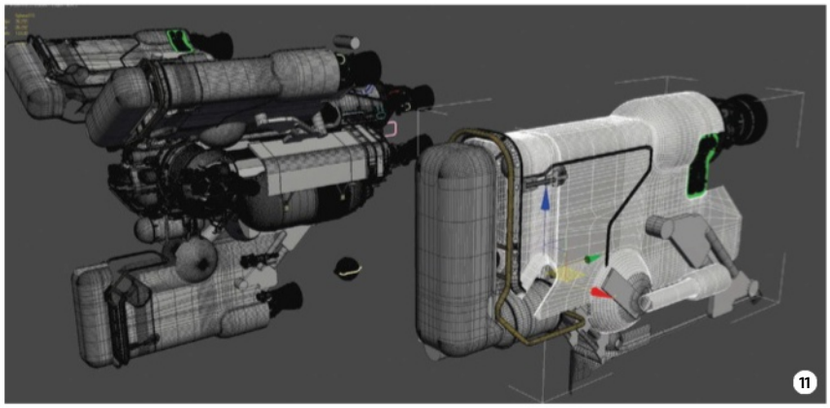
Door Cut-out No.2 **3ds Max, V-Ray, Photoshop (2013)**
I created a series of door designs with the intention of exploring sci-fi design ideas and techniques.

Camera Skeleton **3ds Max, V-Ray (2013)**
A hard surface modelling exercise based on several SLR camera skeleton reference images.

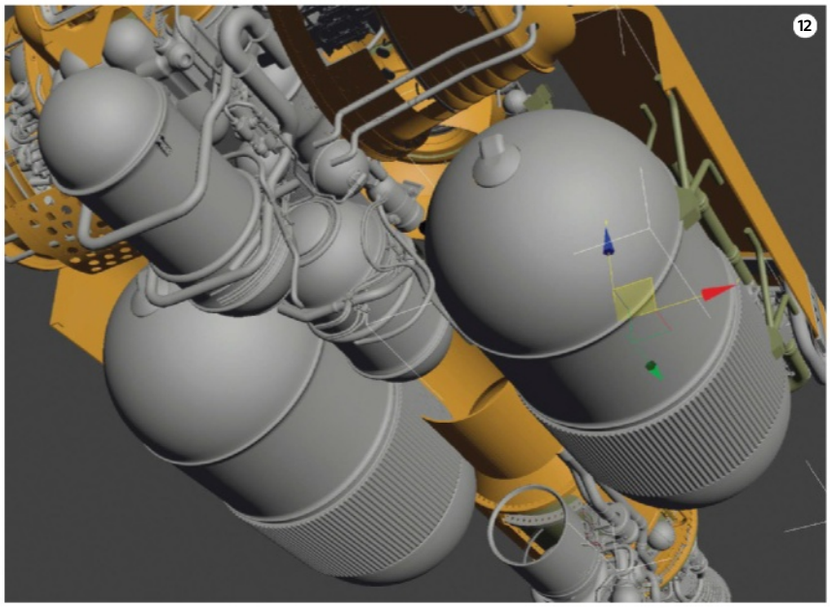


Reuse and instance

Recycle existing elements in other areas for faster production



11 Instance the bumper wings Since all three of the wings are pretty much identical, make an instance copy of the bottom wing and move it to the side to start the design process. Each wing should have its own rocket engine on the back to provide greater pushing power. Copy over one of the earlier modelled engines and try to find a decent spot for it on the wing. We want the main shape of the wing to essentially be a thin metal cover for all the mechanics that are hidden underneath. Use a Shell modifier on top of the TurboSmooth modifier to quickly see how the element looks. Our aim with this is to imply that underneath this metal covering are all the functional mechanics that enable the ship to operate, so imply this with slight gaps in the plating that hint at the tech below.

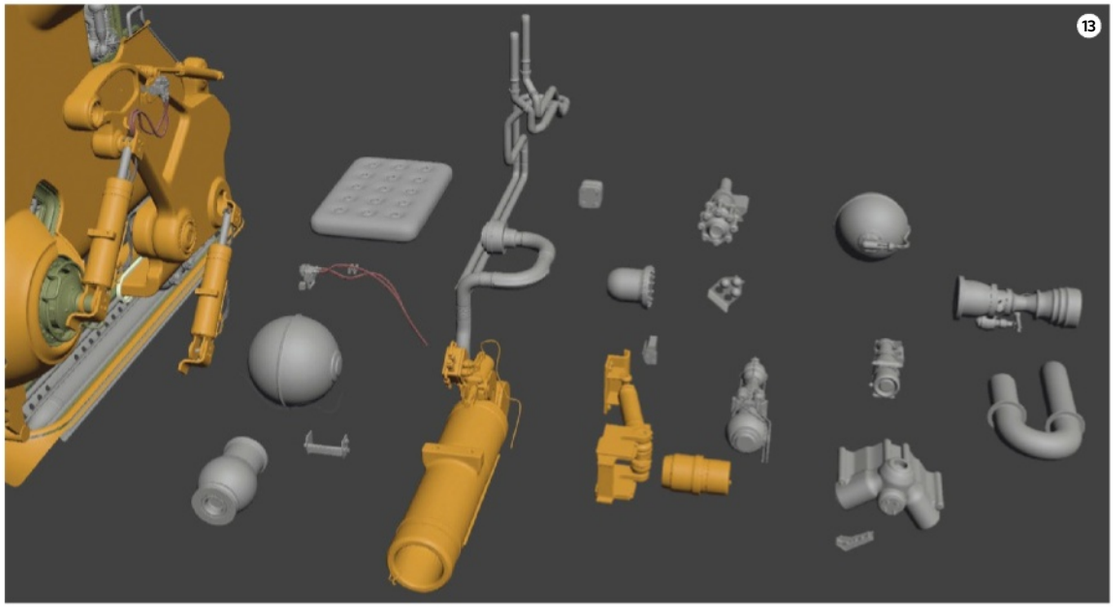


12 Include the fuel tanks Since this space tug spends all of its time manoeuvring other, much larger ships, it consumes a serious amount of fuel. Suspend two large fuel tanks on either side of the craft to help communicate the idea that this is a gas guzzling craft. The two large capsule-shapes suspended under the large metal plate wings will offer an interesting shape to the side views of the craft, and will also create a focal point from the three-quarters perspective. I also wanted to imply that these element originally came from a different ship at some point, so I made them look a lot grittier and more worn out than the rest of the ship.

13 Add details and kitbash Once the main forms are modelled, start filling in emptier areas with detailed elements. Make sure not to overdo this step, as the design can very quickly become a mess of noise. By this stage of the process, we have already modelled many different objects around out craft that could be kitbashed in other places to save time. Since many of these details look quite similar, it is easy to reuse pieces from other places. This has the added side effect of helping to unify the language of the design by sharing forms and generally simplifying the production process.

Self-critique and its importance

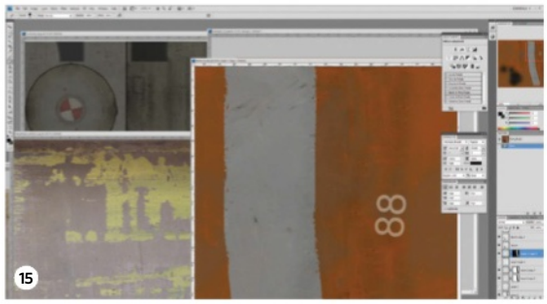
Don't lose sight of the big picture. Zoom out and examine the model as a whole – don't rely on details to sell a piece. Is the silhouette interesting? What are the main focal points of the image? Are there enough interesting angles which will enable this ship to be viewed well from different angles? How does the weighting feel? Is the design properly balanced? These are all elements that you need to consider when self-critiquing your work.



Texture and render

Generate materials and add the final lighting and composition

14 Unwrap and texture Almost all of the objects should be UVmapped using a box or spherical projection. A few elements will require more refined textures, so these can be hand unwrapped. For these objects, do a quick Flatten map in the UV Layout editor, then stitch the elements together, depending on how exactly you wish to paint them. Using a website like **www.cgtextures.com** can be a good resource for finding free textures. Try to stay away from noisy textures in preference of ones that read well and won't distract from the modelled forms.

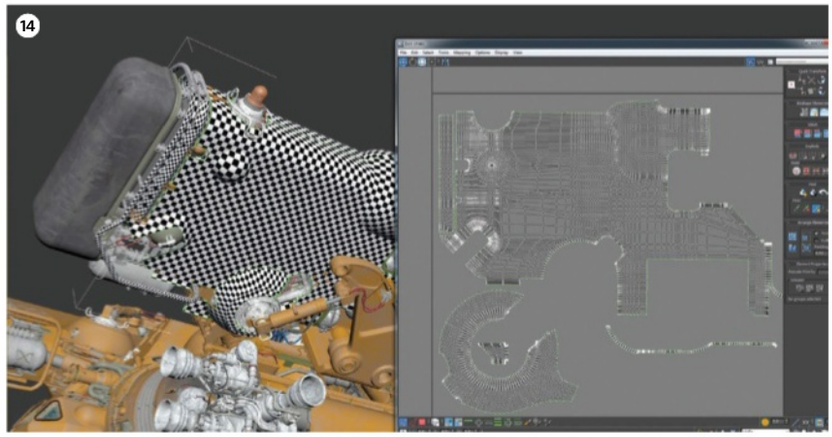


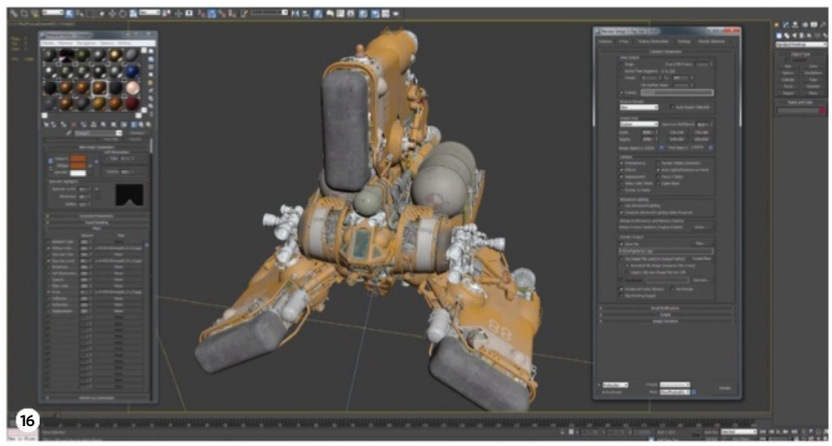
15 Paint to indicate functionality From the start, I wanted the tug to be painted in some sort of bright red or orange colour scheme to help reinforce the idea that it is a construction vehicle. We want a bit of dirt and grime collected on some parts of the vessel, especially around the RCS rockets, where some of the paint surface would have been charred by the repeated firing of the engines. Also, I wanted to indicate that the three wings might have been recently replaced of refitted, so I used a different surface material for the engines to contrast with the cleaner material used for the three wings. Similarly, the two main fuel tanks also have an increased amount of dirt on them to indicate that they have been possibly sourced from another tug.

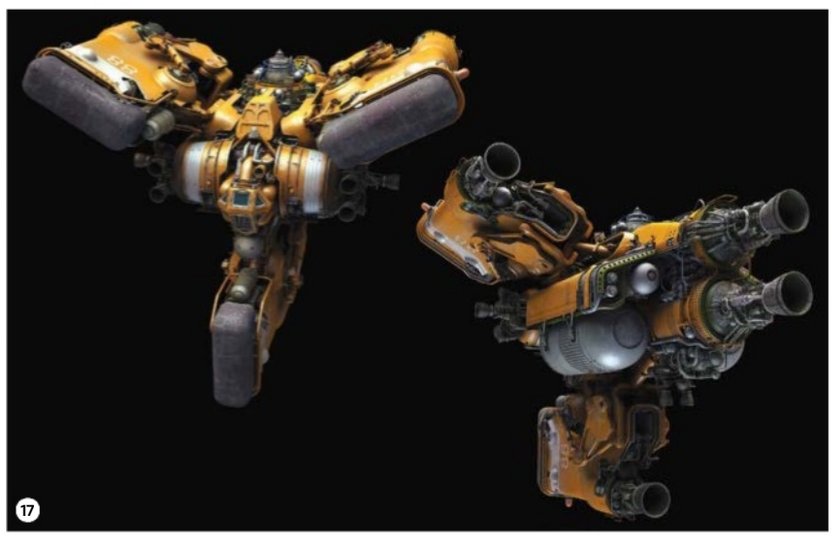
16 Set up the render The last remaining steps concern generating the final renders. Since we've been doing regular renders during the duration of the modelling process to course correct and self-critique, we should have a pretty good idea of how the final image will look. Place V-Ray cameras along the main viewing angles – this includes both orientations of the craft (upside down and right side up). We should also add a three-point lighting setup, with the main light source coming from the top and a softer blue hue illuminating the bottom details. Do smaller, lower quality renders to check the exposure levels, shader work and so on, before committing to the final, high-quality renders.

Embrace the whimsical

Spacecraft design is a highly crowded space, but that does not mean you have to fall back on clichés. Explore new and interesting avenues and do not be afraid of the absurd. Implied functionality can justify even the most crazy designs. Have fun and experiment with many different ideas – oftentimes useful elements will arise from the process of quick iteration.







17 Perform final tweaks For the final renders shown at the start of the tutorial, I inverted the spacecraft to show how the design works when turned upside-down. Along with those views, make some renders of the rear engine assembly. In Photoshop we'll need to do some minor tweaking and adjusting of the renders, such as colour balance and contrast. Such a detailed model can generate many interesting render opportunities, so take advantage of all of them. Hopefully during the duration of this process a variety of design ideas have been generated that can be applied to any model you decide to work on in future.

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I made this...

Incredible 3D artists take us behind their artwork

Artist info

Ahmad Turki

Website www.ahmadturki182.wix.com/ahmadturki

Country Jordan

Software used Maya, Photoshop and After Effects

Bio 3D texturing artist working for Rubicon Group Holding in Jordan

> Texturing the wall was a lot of fun. I used a variety of wall textures to achieve a specific look, and then using Pix Planet I generated a Normal map to add more depth to the all of the details

Doorstep 2013

I've always been fascinated with the idea of creating realistic images using 3D software, so I went about exploring how to create them. Since I love old, rustic places like this one, I wanted to try and re-create and capture all of the elements, making you almost feel the memories of visiting such places.

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Step by step

Easy-to-follow guides take you from concept to the final render

Artist info

Drea Horvath

3DArtist online

Username: Drea

Personal portfolio site www.ddcreations.eu

Country The Netherlands

Software used Vue xStream, After Effects with Optical Flares and Element 3D plug-ins

Expertise Over five years of experience working with Vue. Creates 3D environments, including lighting and textures

Animate scenes in Vue

D&D Creations Logo Animation 2014

"For our logo animation, we wanted to create a video that zooms out from a close-up view of a jungle to a wider shot from above"

Drea Horvath is a 3D environment designer as well as the owner and co-founder of D&D Creations

With the Disc

Tutorial files:
- Tutorial screenshots

Learn how to

- ☑ Determine your workflow before getting started
- ☑ Animate smooth camera movements in Vue
- ☑ Use Vue to add a breeze to your scene
- ☑ Animate a sunrise, water and material surface
- ☑ Optimise your scene (including your meshes) for rendering
- ☑ Find the right render settings for your scene
- ☑ Make final adjustments and add extra elements using After Effects

Concept

I started out by creating a script of what I wanted to achieve in Photoshop, which you can see below. The script contains a sketch of each key step, the duration as well as a short description of what I'm planning to do in the animation.

Vue, the software created by e-on, has been used in a range of incredible films. This is usually for backgrounds or matte paintings, but in some animation films, such as the 2013 blockbuster *Epic*, you can find a series of animations that were entirely made in Vue. Though the industry is gradually progressing further with integrating Vue into production pipelines as a tool for animating scenes, there are still only a few reviews on Vue's capabilities when it comes to animating entire scenes. So, instead of illustrating the creation of another still render, this tutorial will demonstrate how to create an animated logo, in this case for D&D Creations.

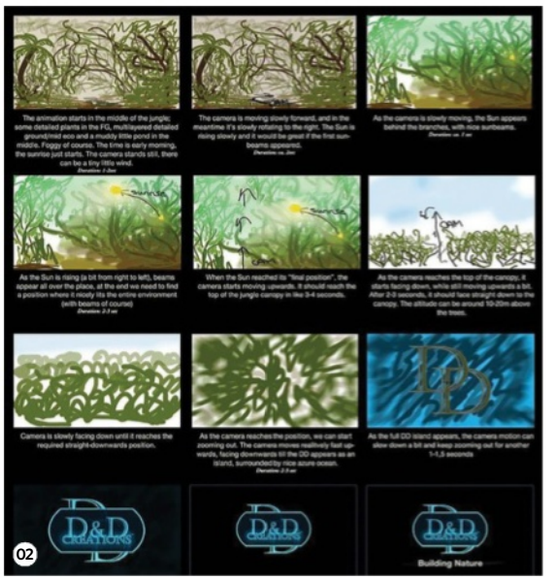
I will highlight the most essential steps to produce an animation in Vue. Instead of going into the details of building the scene itself, I will show you how to animate the elements of the scene, including the water, material surface, breeze and camera motion. I will also highlight the importance of planning before you get started, and I will provide a few tips on how to make corrections and add extra details and effects to animations using After Effects.

Plan ahead

Convert your ideas into a script

01 Choose a theme When it comes to logo animation – or any kind of promotional material that represents your company – it's important to pick a theme that showcases your main area of expertise in one package. Since D&D Creations specialises in creating and animating natural 3D environments, we needed a short animation including everything that we work on. For us, a lush jungle on an island surrounded by the ocean with a sunrise creating beautiful sunbeams through the flora, all blended with our logo and tagline, sounded ideal.

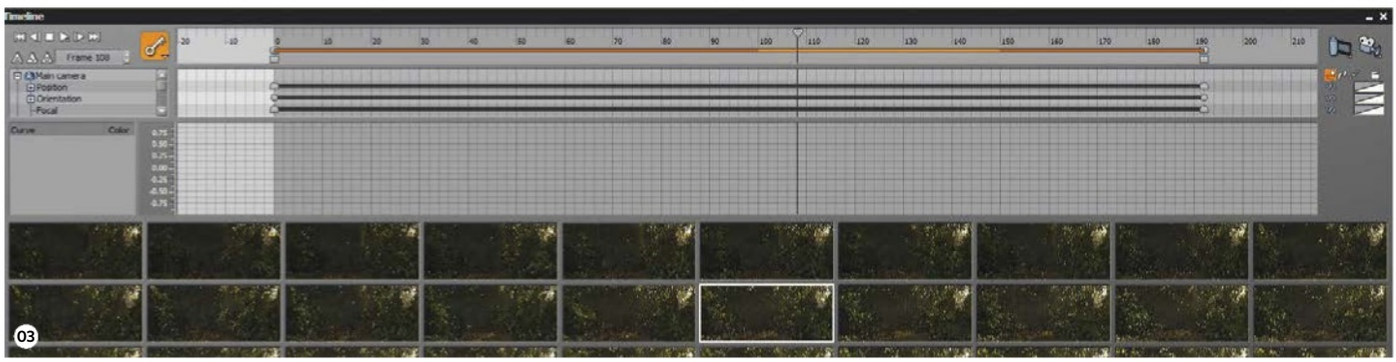
02 Make a script Since there are a million ways to get lost in an animation production, regardless of its length, the most convenient way to get started is to create a script. This should include sketches, ideas and the length of each part you illustrate. Though your plans might change during production, a script is an essential guideline for the project. For this, I made a script with very quick and rough Photoshop sketches to illustrate the steps of our animation.



03 Divide the project into acts After creating our script, we'll need to consider what is and isn't possible based on the features and capabilities of our tools. It might be best to choose a fairly simple pipeline. Obviously the scene will be built and animated in Vue, and we've opted for Adobe After Effects for the blending and post-production. Since different parts of the project require different scene optimisation and rendering strategies, let's divide the animation into acts. Act one, two and three involve three parts of the Vue animation and each will be saved in a separate scene file, while act four will involve the work in After Effects.

Plan your scene as a chain of acts

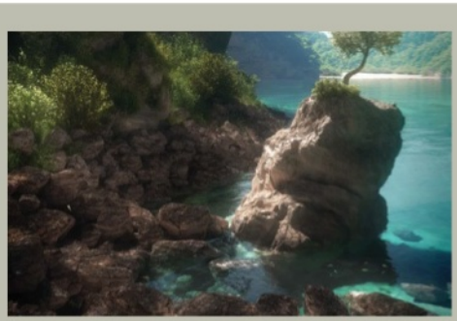
While it's not always necessary to create a concept or sketch for still renders, for animations it is essential to make a script before getting started. Animations require different settings and there are many more technical aspects to pay attention to. Before building the scene that you want to animate, you need to have a clear idea of what you want to produce. You'll also need to set up a pipeline to avoid the production turning into chaos. First, determine which applications and which features you will use, how long the animation is going to be and, with sketches, illustrate the key steps. It also helps if you divide the full animation into different sections or acts, especially if different parts will require a completely different lighting or render setting.



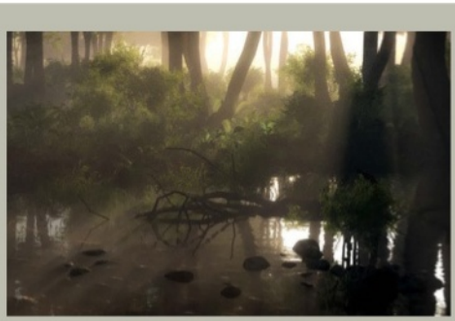
Artist Showcase

Drea Horvath

I've been working with Vue for more than five years. My main areas of expertise are 3D environment design, including composition, lighting and atmospheric effects. At the start of 2013, I founded D&D Creations with my partner Michel Rondberg. D&D Creations offers a different kind of media service and it also develops 3D content, which is sold online.



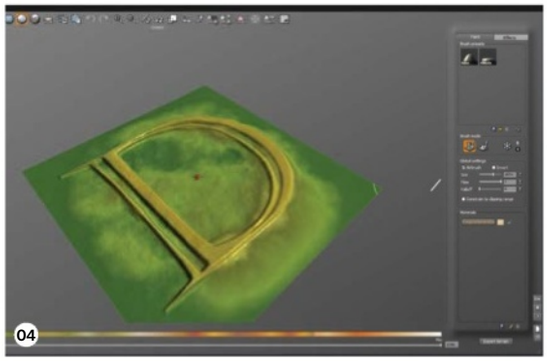
Rocky Shore II **Vue xStream, Photoshop, Filter Forge 4 (2014)**
My goal was to make a tropical scene with a bright blue sky and photometric lighting based on an Italian coast.



Rural Morning **Vue xStream, Photoshop (2014)**
This is a scene I made for release as a scene product at our webshop. It presents a realistic forest morning with a murky water model and photometric lighting.

Build the environment

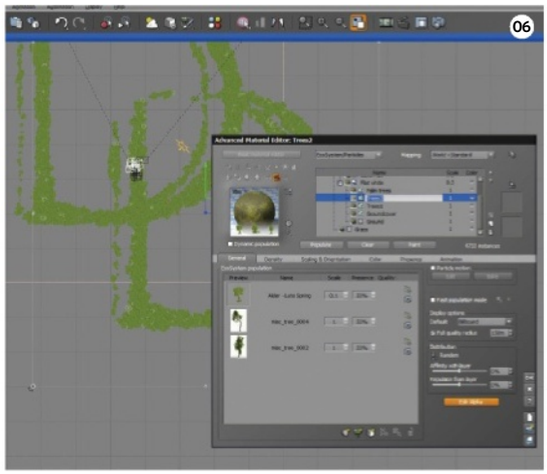
Use your script from the previous step to create your scene

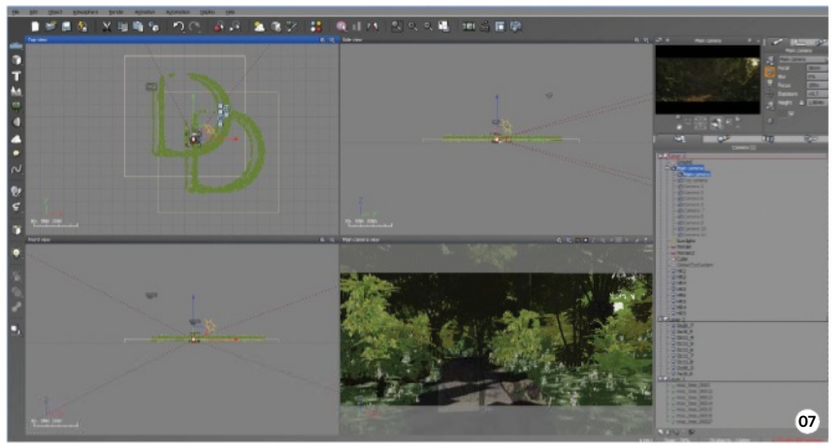


04 Make the island For this scene we want to start the animation deep in the jungle, then raise the camera above the canopy. As the camera flies higher and higher, a double D-shaped island will appear in the middle of the ocean to provide the transition between the scene and our logo. To get the exact shape of the island, make a Custom Terrain brush in Photoshop and, using the Castellar font type, blur the edges a bit to get a softer shoreline. In Vue's Terrain Editor, we should use this brush to create the D-shape of the terrains and, with some sculpting, add some underwater details.

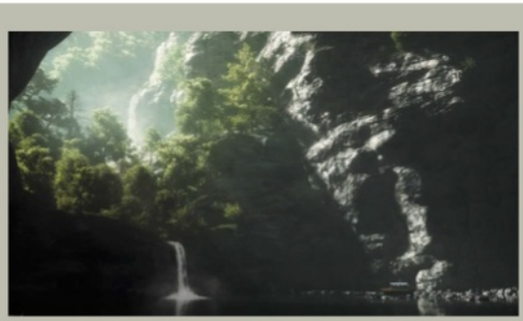
05 Find a starting point The next step is to find the spot where the whole animation will start, and where the jungle needs to be built. The detailed jungle is located in the middle of the island, surrounded by a less detailed environment of some tropical trees. When the first camera location is set, create a basic jungle atmosphere with thick fog and low, thick haze.

06 Add a river and vegetation Dig a small river to the middle using the Terrain Editor and start building a detailed, multi-layered ecosystem around it. Try not to make it too dense – we want to make sure that enough light can get through the vegetation. Make a separate layer for rocks, groundcover, bushes and medium-sized tropical plants. High-poly trees can be added manually. The groundcover plants are SolidGrowth plants, while the rest can be picked from xFrog's Shrubs, Tropical and Oceania collections.





07 Finalise the scene When the jungle part is ready, we need to add vegetation to the rest of the island. This doesn't require a lot of detail, since you'll only see it from top view. Pick three types of lower-poly SolidGrowth plants and, using variable scale and density based on fractals, populate the rest of the island. As a last step, we should tweak the waves with Bump variations, the Foam amount and the physical transparency of the ocean until all the elements of the scene are ready to be animated.



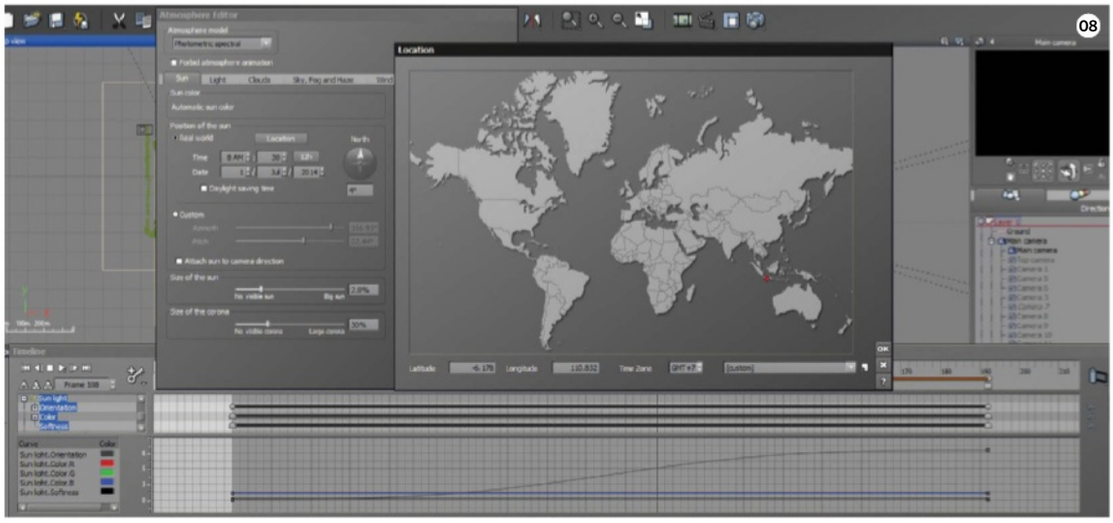
Cave Exploration (ver. 2) **Vue 11.5 Infinite, Photoshop, Filter Forge 3 (2013)**
An updated version of my original scene from 2012, which made it into the finals of e-on software's 3D Environment Contest.

Animate nature instead of specific objects

If you want to animate the natural elements of your scene instead of a specific object, you can set the parameters in the Editor and fine-tune the curves in Vue's animation timeline. Though Vue offers you the option of Auto-Keyframing, it's probably best to avoid it. Adding your keyframes manually gives you more control over the animation and you avoid any unwanted object animation. Familiarise yourself with the Curve Editor, experiment with adding splines (for example, to smooth out an animation) and use the Animation Preview option to see how your modifications will work in practice. If you want to save time, you can preview the animation at a lower frame rate.

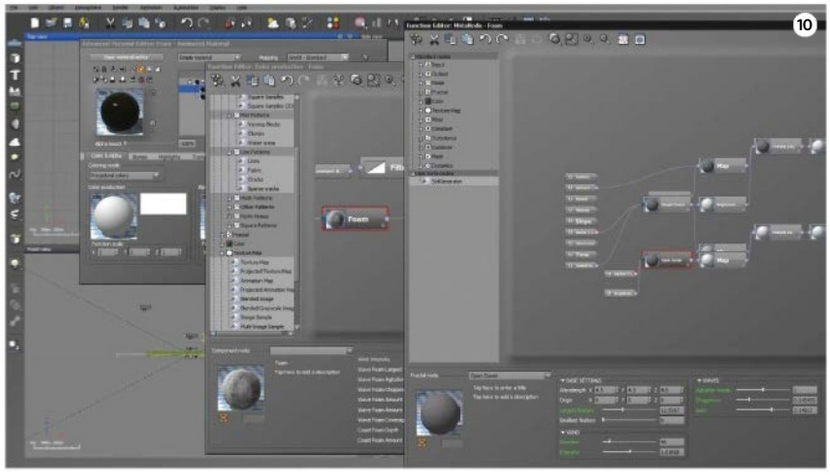
Bring the scene to life

Add natural elements, such as atmospheric lighting and water

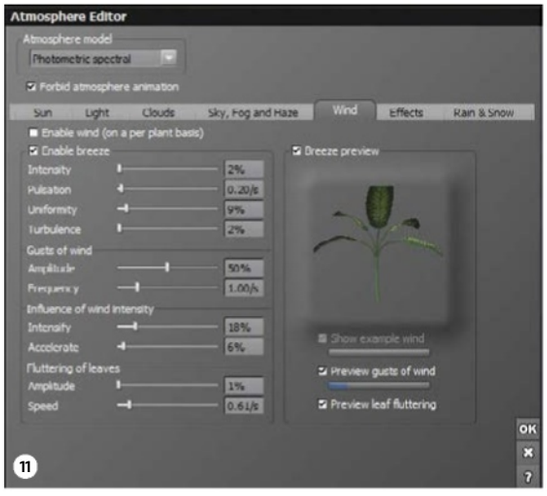


08 Create a sunrise The brand new real-world Sun position introduced in Vue 2014 gives us the option to animate the sunrise. Instead of the old ways of determining the orientation of the Sun, we can animate these features based on real-time and location. In our animation, the Sun rises from 6am until 8.30am in about eight seconds. In order to make rays of light appear, enable Volumetric Sunlight, while using a Photometric Lighting model to get the most realistic effect.

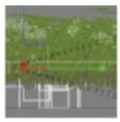
09 Animate the water Since in our scene there is a slight level difference between the ocean and the pond in the middle, use a cube with procedural, fractal-based Bump mapping to create smooth waves on the pond surface. This means that we will use two different methods for animating water. We will animate the ocean based on our settings in Vue's Water Editor. The ocean and water material animations are the only elements where it's better to enable Auto-Keyframing, then tweak the settings at Frame 0. For animating the ocean, it's essential to enable Displacement.



10 Make waves with material animation To animate the waves of the river, go to the Function Editor and use the Foam layer's Fractal node, connected to both the Time and Position inputs. The Foam layer of the default pre-animated water material of Vue contains the Open Ocean fractal, which has control over the water's Agitation, Choppiness, Wind Intensity and Direction, as well as the Wave Variability. These settings are applied to the Water layer as well. In order to make the foam invisible, the Alpha Boost of the Foam layer needs to be set to -100%.



11 Add a breeze In nature, wind is barely noticeable in jungles, since the thick jungle canopy blocks it. However, we want to add a slight breeze to make the animation look more alive. In the Atmosphere Editor's Wind tab, disable Wind On A Per Plant Basis, but leave Breeze enabled. Vue's Breeze Preview helps a lot in determining the several Breeze values. We'll have to pay extra attention to the Fluttering Of Leaves, since values that are too high can cause severe flickering, which requires a lot of anti-aliasing and results in a very slow render speed.



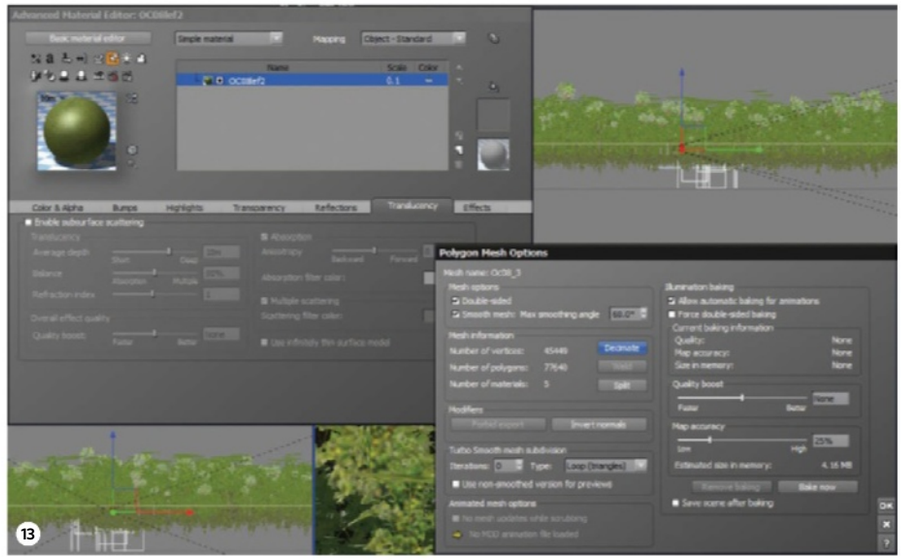
Optimise the scene

Include any final tweaks and then post-process in After Effects

12 Animate the camera motions
Since we're following a script, disable Auto-Keyframing and instead, set them manually. A convenient way to animate the camera is to use dummy primitives, such as a sphere or cube you can hide from rendering and link the camera to the object. This makes it easier to do small corrections without modifying the camera all the time.

13 Optimise for the animation A major part of the vegetation consists of high-quality xFrog plants with high-res textures, fine Bump mapping and subsurface scattering on the leaves. SSS can add realism to a render, but it increases the render time significantly, so we should turn it off and use 100% backlight on our leaves instead. Reset the Bump maps on the trees, weld the meshes and reduce the polygon count by half.

12



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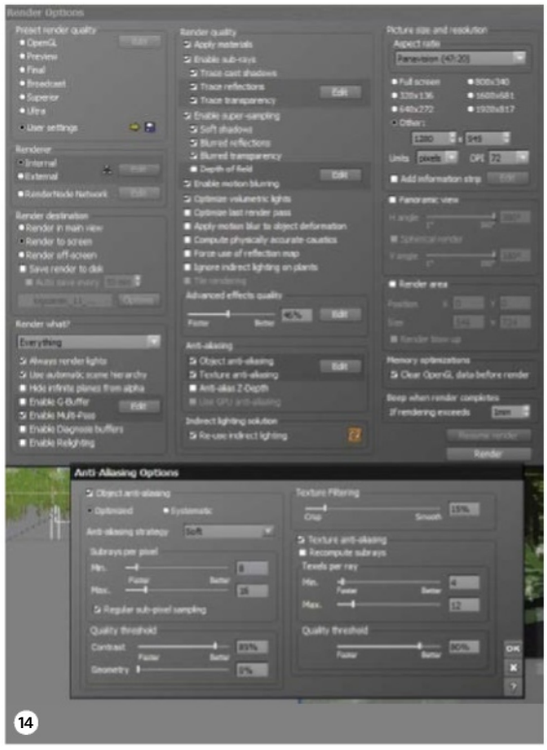
14 Customise the render settings In Vue, make good use of illumination caching. Render a single frame twice as large as the actual animation resolution, then render the animation with the Reuse Indirect Lighting option enabled. This way, Vue automatically updates the indirect lighting data, resulting in a faster average frame render time. We'll use a soft anti-aliasing strategy with 15% texture filtering to reduce flickering. Texture anti-aliasing should be used to deal with possible interference in patterns. In the Advanced Animation Options, enable Deterministic anti-aliasing and Multi-frame anti-aliasing to make the animation look even smoother.

15 Post-process in After Effects After all of the three acts have been rendered, import the sequences into After Effects. This is a perfect tool for corrections and compositing. In After Effects, just like in Photoshop, you can apply the same Color, Hue/Saturation, Level and Curve corrections on the entire sequence, along with filters and special effects. After some minor Contrast and Level adjustments, plus a little bit of noise reduction, we can use two great plug-ins from Video Copilot to add extra effects. Optical Flares is great for adding a subtle lens flare effect, while Element 3D is useful when you want to add dust particles.



14

Useful tips for your final animation

Rendering animations created in Vue can be challenging. Vue is built for handling complex, resource-hungry scenes and it mimics natural lighting using ray-tracing. Due to the countless number of calculations Vue needs to make, the average render time per frame can be very long. Another important thing to bear in mind is that in a Vue animation, frames are not homogenous – one frame may take 15 minutes the render, while the next may take two hours, based on the calculations Vue has to make on that specific frame. This is why it's important to find the most suitable render settings and estimate the render time by doing test renders. A good method to estimate the average render time per frame is to render the animation at one frame per second so you can see which part needs further optimisation.

Another well-known issue is flickering on plant leaves and complex textures. To find the optimal anti-aliasing settings to reduce flickering, it's usually enough to pick between ten to 25 frames from the sequence to render.

15

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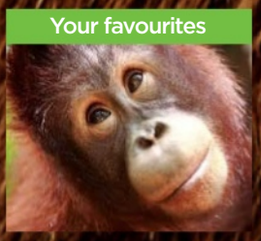

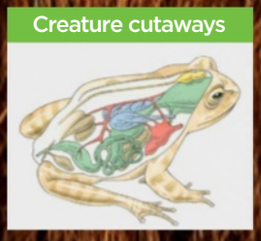

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Artist info

Tomi Väisänen

Website www.tomivaisanen.com
Country Finland
Software used 3ds Max, V-Ray, Fusion and Photoshop
Bio Tomi is a 3D generalist, compositor and CGI enthusiast currently working at RedLynx

“A simple and easy way to add detail is to recycle your old models. Most of the parts in this image are just old models that have been ripped apart. Symmetry, Bend and FFD-modifiers in 3ds Max made sure that details aren’t recognisable”

Journey Awaits 2012

Who doesn’t love steampunk airships? I wanted to create a mood of leaving, or the beginning of a journey. As with most of my pictures, I love to play around with details such as nuts and bolts. This one gave me plenty of opportunity to do so. Besides, there’s just something cool with having huge machinery surrounded by a calm environment. The image was greatly inspired by airship designs from the *Final Fantasy* videogame series.

3DArtist

Masterclass

Clarisse iFX tech evangelist Rainer Duda offers an insight into how artists can improve their workflow using this exciting software

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Building blocks with a modular intermediate level

Build detailed structures with Clarisse iFX

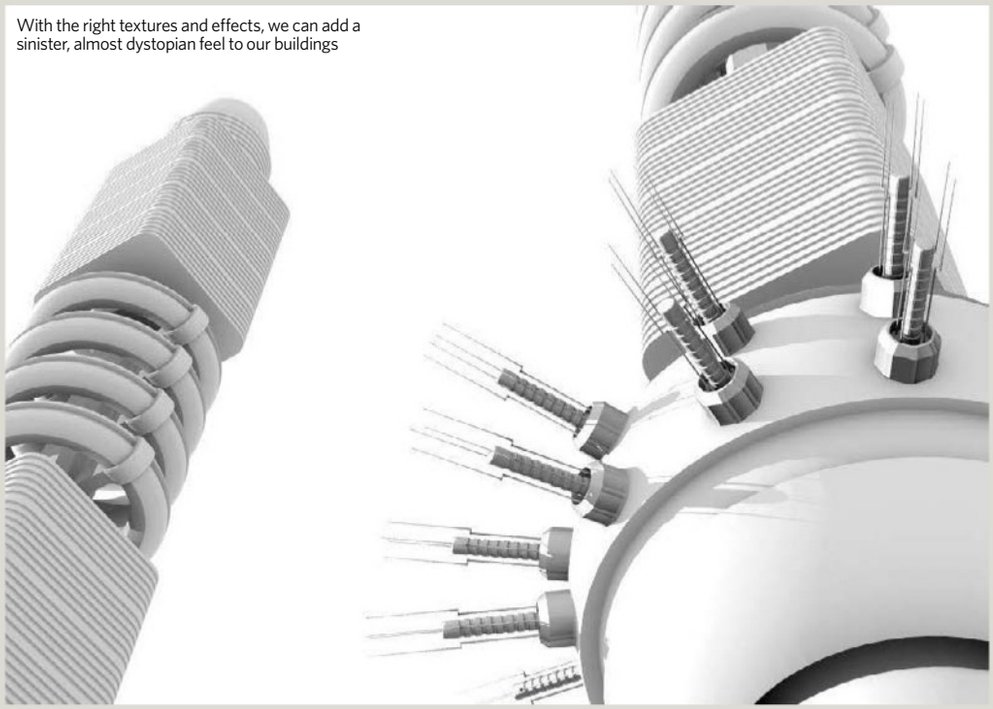
"Learn how to create complex sci-fi structures using a simple suite of 3D tools"

The main aim of this tutorial is to use Clarisse iFX to build detailed structures within a reasonable timeframe with only a moderate amount of work. Sometimes artists waste time by spending it on asset refinement, putting hours into carving out detail in their assets, but in a professional production environment there's simply not enough time for this. By using Clarisse iFX and a procedural object-based workflow, artists can create very detailed structures within minutes, while also leaving a lot of room for modularity.

We will start by looking at some great-looking, modular 3D pieces for a science fiction building, preparing them with correct pivot positions and finally exporting them to Clarisse iFX. It's important to be aware of the two categories of pieces that we need – pieces to build the actual core buildings and some for decorations. We'll also need to find out which pivot positions will work the best.

Inside the application we will first import the assets and assign the materials plus corresponding textures. After this we will build a special base – a template – which will be filled later on with the 3D building pieces, including some decorations. This template basically consists of a special Point Array setup. The Point Arrays and 3D pieces are inputs for a special tool called Scatterer. We'll dig deep into the Scatterer functionality and explore how to perfectly use this advanced tool to build modular buildings. To take advantage of the procedural object-based workflow, the core buildings – known as objects in Clarisse terminology – will be used as a base for another Scattering action, but this time based on a Point Cloud. At this stage we'll learn how to use a Point Cloud in combination with the Scatterer to place decorations around the buildings for a more detailed structure. This system can be adapted for use in a variety of projects.

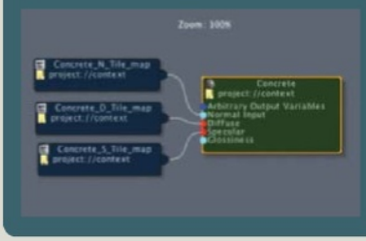
After the buildings are done it's time to tackle the process of generating a final image in Clarisse iFX using a function called Image View. Therefore, our last task will be to build a solid base for the final image. We'll cover the correct lighting setup, consisting of a Distant Light and Global Illumination. In addition, we'll place a camera and jump right into Image View to work directly on the final image using Clarisse's brute force ray tracer.

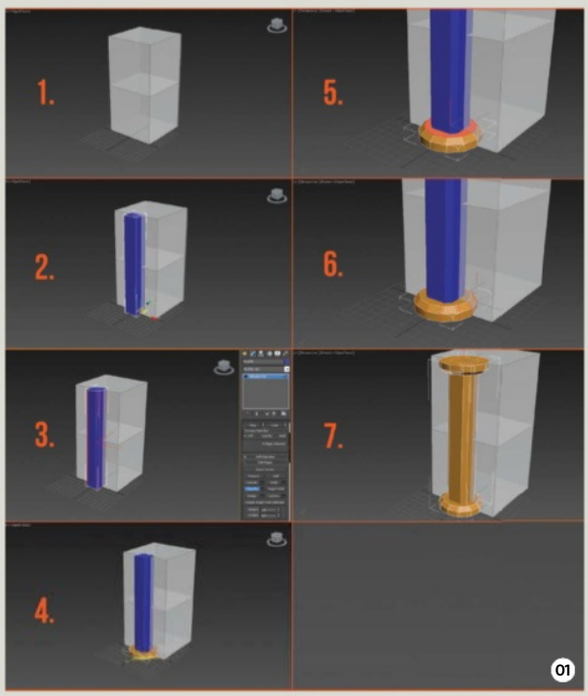


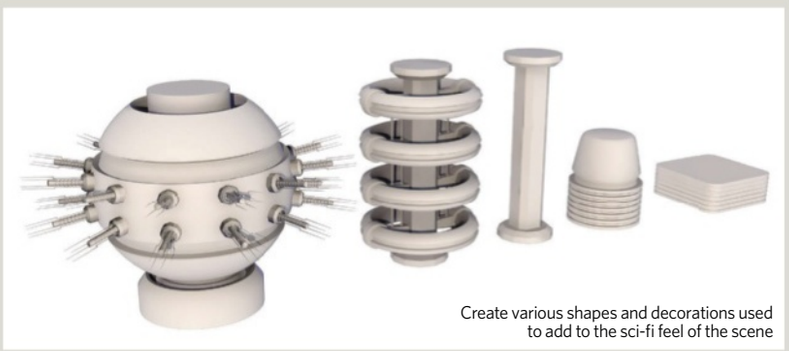
With the right textures and effects, we can add a sinister, almost dystopian feel to our buildings

Add materials and textures to your art

Clarisse iFX's materials system works in a similar way to other 3D applications. Create a new context and import the textures via File>Import>Texture>Map File. After that, create a material by right-clicking on an empty spot in the browser and go to New>Material, where there are several materials available to choose. Once a material is selected, there are two ways to assign textures. One is in the Attribute editor, which you can access by clicking the checkerboard icon, or by using the Material editor, which can be opened by changing the editor type.





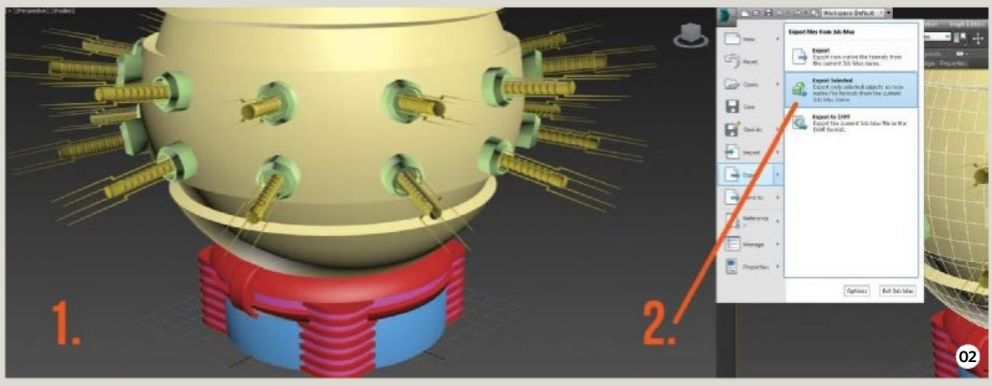


Create various shapes and decorations used to add to the sci-fi feel of the scene

Create detailed and modular objects

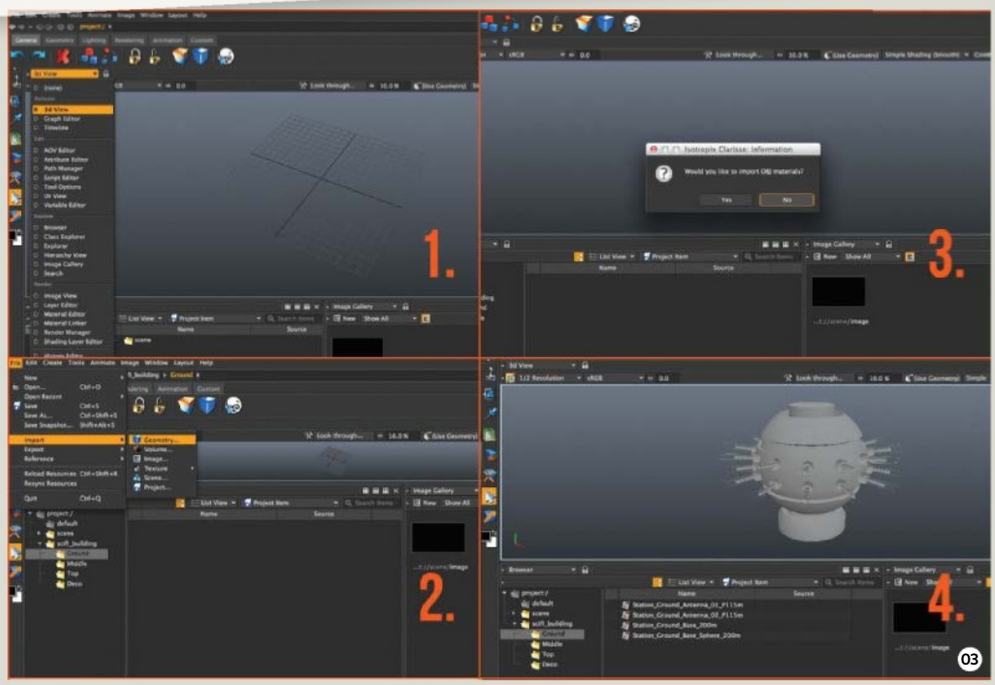
01 Choose your assets

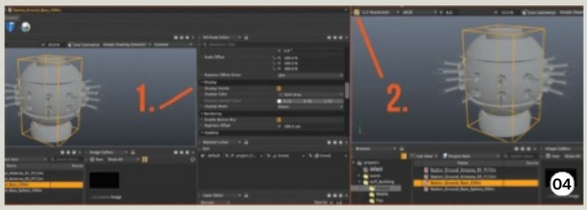
First jump into 3ds Max and create modular assets using simple shapes. It's really important to keep the correct height in mind. We will work with reference boxes of between 100 and 200m. This reference is highly important when you want to add your own assets. If there are any uneven numbers then it will be a pain to set up the system correctly. Therefore, in the Create pane we will use only standard primitives, such as boxes and cylinders. To give these simple assets a nice shape, use only modifiers like Extrude, Inset and Connect followed by a chamfer. To save modelling time, all assets are available with the issue.



02 Correct anchors for working modularity

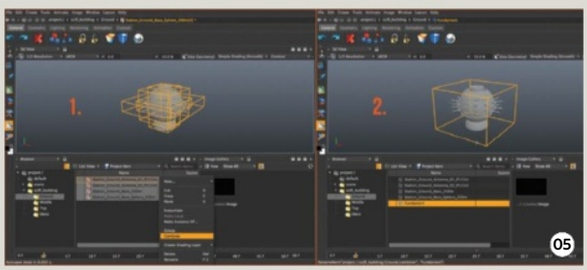
It isn't just the correct dimensions that matter when you're working with a modular asset system. It's really important to understand the correct pivot position to plug the assets seamlessly together. Before exporting all the assets, we need to place them centred on the grid, except for the ground decorations. The pivot must be centred at the origin. To do this, select all meshes, go to the Hierarchy pane, select Affect Pivot Only and use the Standard Translation tool to bring the pivot to the origin. Now we can export the mesh as an OBJ file by going to File>Export Selected.





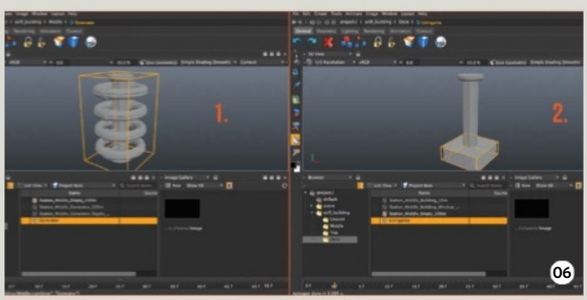
03 Open the files in Clarisse

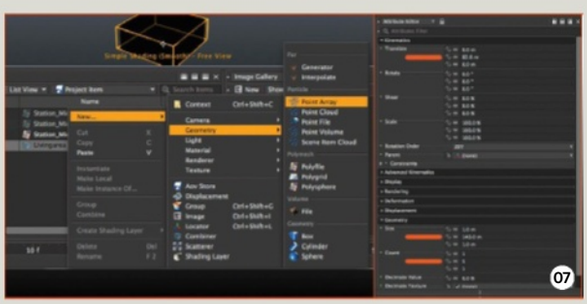
We need to bring all the assets into Clarisse iFX, but before we do that it's time to swap to the 3D viewport. In the upper-left corner we need to tell the Editor field that we want the 3D view. Now create a new folder – referred to as context in Clarisse – in the browser on the lower-left corner by a right-clicking on Project and activating New, then Context. We should call this context scifi_building, then add four more contexts inside called Ground, Middle, Top and Deco respectively. Now import the corresponding assets without materials into each context by clicking File>Import>Geometry.



04 Keep your workspace clean and manageable

By default every asset that rests in an active folder will be displayed in the 3D viewport, which can sometimes be annoying. To avoid overwhelming your viewport, assets can be hidden. To hide an asset, take a look inside the Attribute editor. There's a section called Display and if the box is ticked for Display Visible, an object is visible. Another function which will save you time involves jumping to the selected object in the 3D viewport view. This function can be activated by using the icon in the upper-left corner of the viewport.





05 Create a solid base

We're now ready to build our first modular part – the base. Let's jump into the Ground context and create a new object called Combiner. Do this by selecting all assets and right-clicking in the empty explorer space. Under New, press Combiner and the object will be created. The next step will be to select each individual asset and hide it. With selected objects we'll need to untick the Display Visible box in the Attribute editor under the Display tab. The last step is to rename the Combiner – in this project I renamed mine to Fundament. A Combiner can hold as many assets as you could possibly want, regardless of its complexity.

06 Move onto the next part

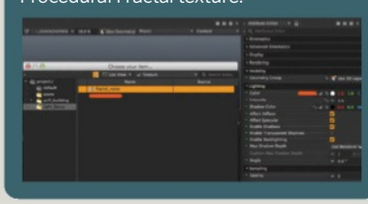
To build the second part, go into the Middle context, select the Generator mesh, plus the Support mesh, which holds the rings. Like before, apply a Combiner object to both meshes and then hide them once more. Now we can use the empty middle part without the generator equipment and build a living area after we've copied it to the Deco context. Inside the Deco context apply another Combiner to the middle building plus the Window Support mesh and call it Livingarea. To keep the scene clear, hide both single assets. On both Combiners we will need to set the Translate values to 0.

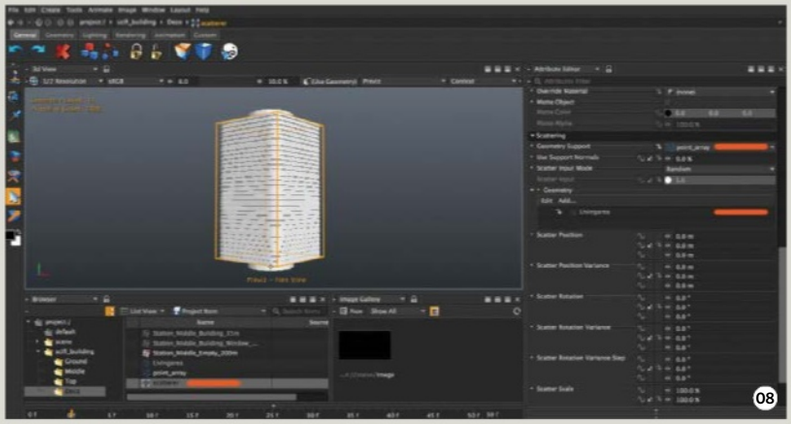
07 Piece the parts together

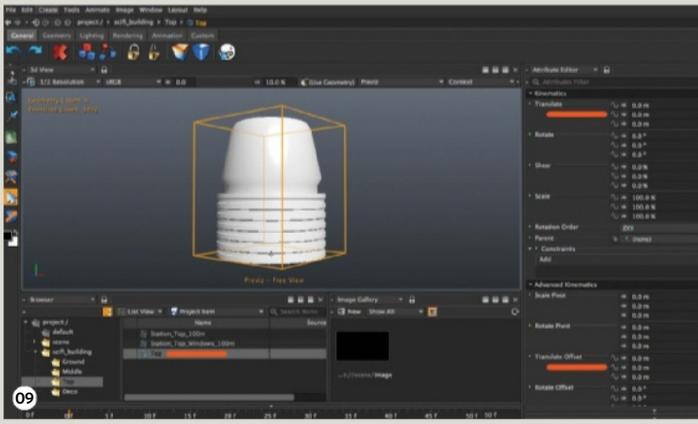
At this point we will need to add two new objects to continue, a Point Array and a Scatterer. Like the Combiner, both are located in the Creation menu, with the Point Array under Geometry. The Point Array will provide us with anchor points to place the living areas. Select the Point Array and in the Attribute editor under the Geometry section, set the Y-size to 140m. In addition, set the Count field to 5 points. Last but not least, go right to the top of the Attribute editor and set the Y-Translate field to a value of 82m.

Light customisation for a better look

The basic light setup placed in the Clarisse iFX scene is okay, but you can add to the look and feel of the light by using a special texture instead of a simple Light Color. First of all, you must add a Procedural Fractal Noise texture, which is located in the menu under New>Texture>Procedural. Now it's time to put it in action. After the Distant light is selected, take a look at the Lighting Region inside the Attribute editor. In the line named Color, click on the checkerboard icon and select the Procedural Fractal texture.







08 Use the Scatterer

Now that our anchors are set the Scatterer can take over and place the living room asset on each point. To do this, select the Scatterer and in the Attribute editor under Scattering tell it that the geometry support, which is where it should place objects, will be our Point Array. It also needs to know what it will be scattering. So, add the Livingarea Combiner into the Geometry field below the Scatter Input mode. At this stage we can hide both the Livingarea Combiner and the Point Array. Only the middle asset and the Scatterer will be visible, which we need to combine and rename to Livingarea_complete.

Pay attention to the measurements

When you are working with a building blocks system like this it's important to keep the correct measurements in mind, in particular the different unit systems inside applications. If you are using Maya from Autodesk, you can be sure that one of their standard units is equal to one metre in Clarisse. If you are using 3ds Max, however, it's a different unit system. Before you start modelling in 3ds Max, make sure you take a look at how the units are set under Customise, then activate the metric system for the System Units Setup.

09 Tidy up your scene and workspace

Our Livingarea_complete Combiner isn't ready yet as we have to adjust the pivot position again. Sometimes the Combiner creates a new pivot position, which is centred to the object. Select the Combiner, go into the Attribute editor and set the Translate Y in Kinematics to 0 and the Point Translate Offset under Advanced Kinematics to 0 as well. The pivot will be at the origin once more. Our last step is to combine the top parts, so jump into the Top context and combine the actual Top section plus the Support mesh for the windows and call it Top.

11 Let the system do its job

To bring in the promised modularity, create another Scatterer and rename it to Modular_assets. In the Attribute editor under Geometry Support, assign our Point Array and under Geometry add the missing assets, the former being the generator piece and the latter being the living room asset. By default, the Scatterer works with a randomised placement method. At this point we're done with our modular building system. To render the scene, drag and drop the three files (Fundament, Top and the Scatterer) to the scene context and adjust the camera with the Standard Transformation tools.

10 Set up final anchors

To finalise the modular system, create a new context named Final_bits. Take all of the final assets from their respective folders and copy them into this context. The idea is to keep the Fundament and the Top piece static and the middle ones modular. Hide the living room asset plus the generator. For the Top piece, add a Y translation of 800m. Let's add another Point Array, starting at the height of 400m (Kinematics>Translate Y). Under Geometry in the Attribute editor, add the numbers 3 for the Y-count and 400m in Y-size.

12 Add final effects

Now we can add a Distant light and a GI object. Both are located in the create menu under the Light section (New>Light). Using the Transformation tools, which can be accessed on the Menu bar on the left, position the light so that it shines on the building. Now it's time to render the scene. Change from the 3D view to the Image view in the upper-left corner of the viewport. Drag the image from the image browser to the viewport and in the Attribute editor switch the resolution of the output image to 720p.

• DID YOU KNOW? • All tutorial files can also be downloaded from: **www.3dartistonline.com/files**

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Back to basics

Jahirul Amin guides you through the process of sculpting the body of a digital cuttlefish

With the Disc

Tutorial files:
- Maya scene files
- Reference images and videos
- Scans and textures
- Tutorial video and screenshots

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The final sculpt of the cuttlefish

Model a cuttlefish in Maya and Mudbox

"In this tutorial, Jahirul Amin explores the process of soft-body modelling using scan data, Maya and Mudbox"

Considering that over 70 per cent of the Earth's surface is covered by water, it seems about high time that we devote our next set of tutorials to creating a creature from its murky depths. Sea life, once you take the time to really examine it, demonstrates that the truth is a great deal stranger than fiction, with pretty alarming clarity. It's little wonder that sea creatures have provided such a lot of inspiration for artists over the years. So, in this four-part series, we'll have a go first of all at modelling and sculpting, next UV unwrapping and texturing, then rigging and finally animating and rendering a common cuttlefish.

There is nothing common about the cuttlefish, however. It is a part of the cephalopod family, which also includes its more famous relatives, the squid and octopus, but seeing as these two species are already well-known, I thought it was time for their poor cuttlefish cousin to become the focus of attention.

The cuttlefish is a uniquely interesting and strange creature and offers the CG artist trying to replicate it a fair few challenges. I wanted the creature I chose for this project to have tentacles, as the techniques used could then be applied to other cephalopods. The cuttlefish has two tentacles that act as grabbers, but it also has eight arms and a frill-like fan running around its body. These moving parts will provide a lot of food for thought. On top of this, the cuttlefish is the chameleon of the sea, being able to swiftly change not only its colour, but also its form as a defence mechanism or as a means of attracting prey. It's one crazy, crafty creature.

In previous tutorials we have created human-like characters, cars and trains. These are all forms with which we are entirely comfortable and familiar, and sufficient reference has been just a few searches away. To do the cuttlefish justice, however, I knew more leg-work would be required. My first port of call was my local aquarium. There, I was lucky enough to watch and get footage of cuttlefish move around and change colour. I was able to get a much better feel for the creatures' very impressive agility. The drawback here, however, was that they were in a tank with

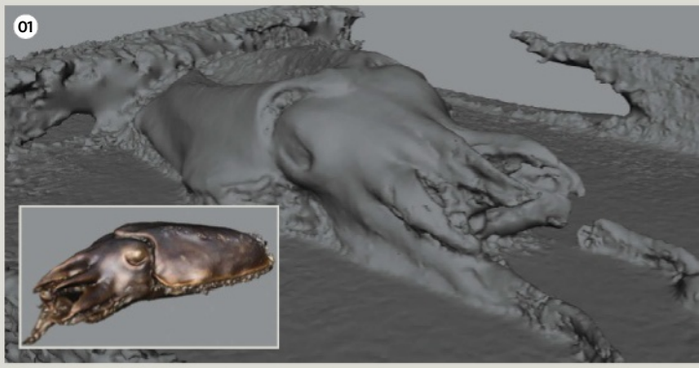
very thick, rounded glass, which naturally distorted some of my shots. I knew that to make a halfway decent job of re-creating a cuttlefish I'd have to be able to get much closer to a specimen.

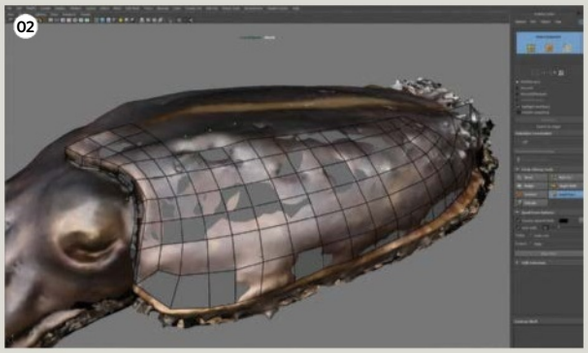
My next two stops were UCL's Grant Museum of Zoology and London's Natural History Museum – I owe the staff at both museums a very big thank you for their help in showing me their cuttlefish specimens. As a result of their help, I was able to get some amazing reference photographs and even actually handle a few specimens at the Natural History Museum.

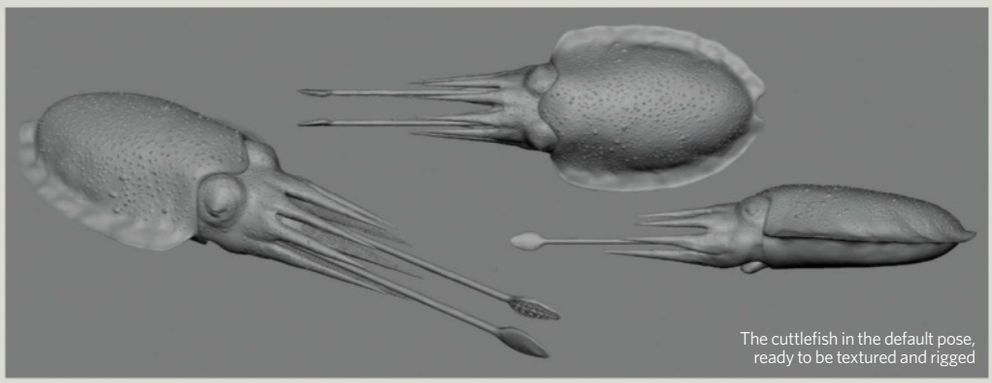
In terms of my approach at this stage, I must say that it did change from my initial intentions. This is one of the many reasons that I love the medium of computer graphics – there is no one way to do a specific thing. My initial plan had been to take a base geometry into Mudbox and sculpt out the major forms, retopologise in Maya and then transfer the details to that mesh and continue the sculpt.

Looking at the amount of reference images I had, I decided to try something a little new to me. First, I took the images into Agisoft PhotoScan (you could also use 123D Catch) and created a 3D scan from the photos. I had several sets of photos, so I created a scan for each set. None of the results were perfect by any stretch and as I could only see either the top portion of the cuttlefish or the bottom while taking the photos, I could not use a single scan as my main reference. The scans provided a good base to start from, however, and by Frankensteining the scans together or just using different parts from each one, I was able to very quickly create the geometry that could then act as the animateable mesh. This could then be taken into Mudbox and pushed further to create the desired silhouette for the cuttlefish and to add finer details such as pimples and folds. The scans were less useful at this stage as the texture of the samples clearly showed the passage of time.

I've supplied a lot of the reference photos, videos and scan data that I used, enabling you to pick and choose to find whatever suits you best.






The cuttlefish in the default pose, ready to be textured and rigged

Start the modelling and sculpting process

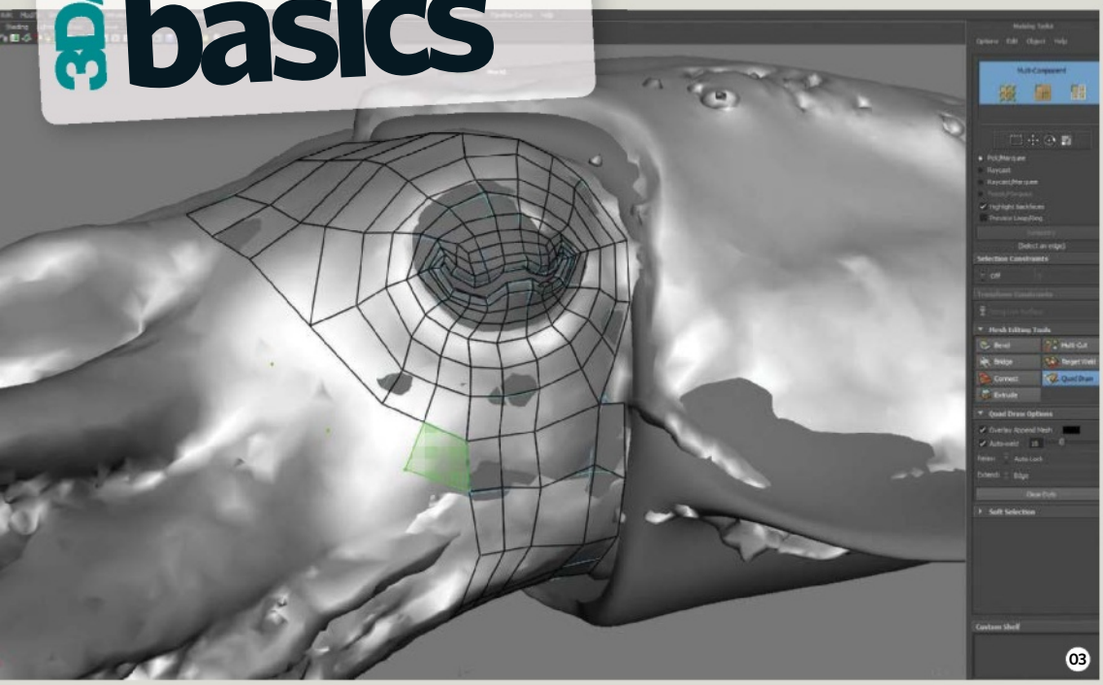
01 Prepare the scan data

The first thing to do is to tidy up all of the scan data. To do this, import each scan into Maya and delete all the irrelevant faces. Then, match the top portion of one scan to the bottom portion of another scan. Through some scaling here and there, we can pretty much get a good idea for the overall proportions of the cuttlefish. It's nothing concrete – the arms and tentacles might be particularly hazy, but it's still a good foundation on which to build on. We will also give each portion of the scan its own Blinn shader and then apply the textures that were generated during the scanning process.

02 Retopologise the mantle

Next, we will use the Modelling Toolkit to retopologise the mantle. For my project I used the Maya 2014 Extension release, which has a Relax feature in its toolkit, which is very useful to even out the edge loops. Using the Quad Draw tool, we'll pretty much just retopologise the top portion of the mantle, then duplicate the mesh and flip it to create the bottom half. This way, the fins on the side of the mantle will share a similar topology to the opposite side. As we create the base geometry, we'll find that the scan data will probably be more of a hindrance than a help in some places, which means we'll need to rely on the photographic reference as a guide.

3DArtist Back to basics



Sculpt with layers

One of the many benefits of working in Mudbox is being able to take advantage of the Sculpt layers. These enable you to work in a very non-destructive manner and by using the Strength value you can also tone down the effect that the layer has on the sculpt. You can also overcrank the value or go into the negative values by typing specific numbers into the Value box.

03 Repeat for the head

Moving on to the head, the main focus is to get clean edge loops around the W-shaped eye. The rest of the head is fairly straightforward, as should be adding the syphon at the bottom of the head. Step out of the Modelling Toolkit to add this and do so with a few simple extrudes. At this stage, start taking the mesh back and forth between Maya and Mudbox as it is a lot easier and quicker to push the forms around in Mudbox than in Maya.

04 Create the arms

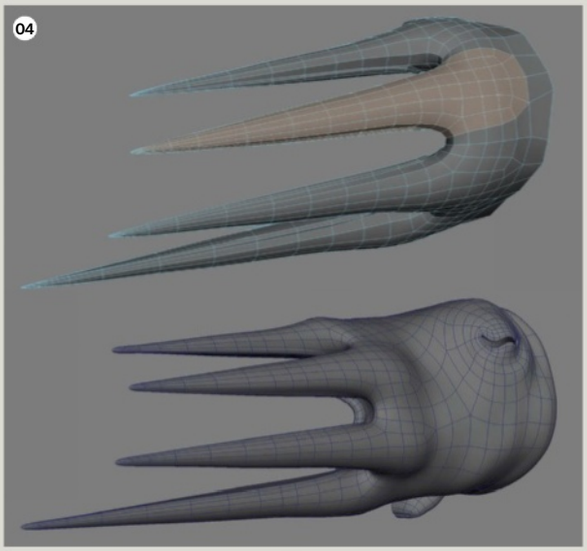
As the cuttlefish has eight arms, try to build one arm in a way that will enable it to be duplicated, repositioned and reoriented and then merge it into the other arms, so essentially a tileable arm. The scan data at this stage will probably be quite useless, so it's a case of using it just to give an idea of the length of the arms and then going on your wits to create the rest. For my project, I decided to model the arms straight out as this makes it easier for rigging purposes later on. Start with a simple cube and add a few Edge Loops here and there. Again, go between Maya and Mudbox to get to the final result. Once the arms are ready, combine them with the head and then create two openings for each tentacle and a space for the beak.

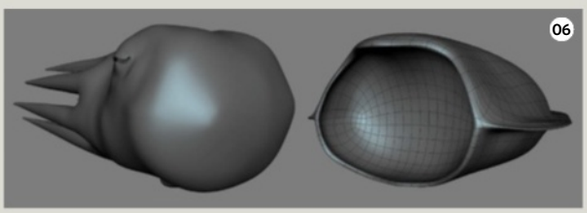
05 Build the suckers

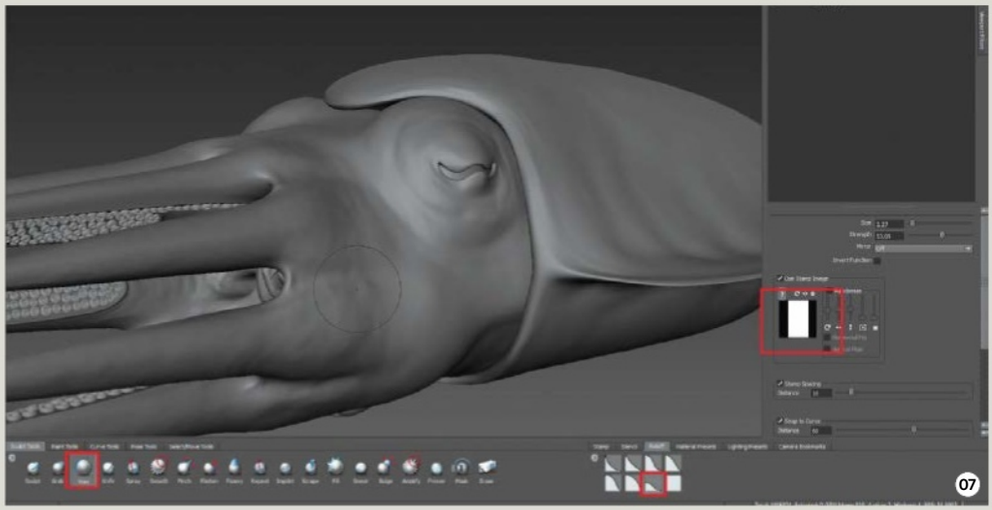
The suckers of a cuttlefish are slightly different to those of an octopus. An octopus has, on average, two rows of large suckers that run down the tentacle and which look as if they are extruded from the tentacle itself. The suckers on a cuttlefish arm, however, look as if they are more embedded into the arm. As well as this, there are around four rows as opposed to two. The end result can be achieved in multiple ways, such as through a Displacement map or by subdividing the arm to give us enough geometry to extrude out the suckers. However, rather than either of these methods, we're going to make a single sucker from a cube and then duplicate this many times to place along the arms of the cuttlefish. We can then simply scale each sucker to look slightly different to its neighbour. Ultimately, when all the suckers are in place, we'll have a heavy model, but sometimes it's better to have physical geometry rather than Displacement maps. At least this way we'll be able to see the suckers in the Maya viewport, rather than having to render them out to see exactly how they deform. Once all of the suckers have been added, merge each set for each arm into a single mesh and then delete the history off the model so that we can keep things as light as possible.

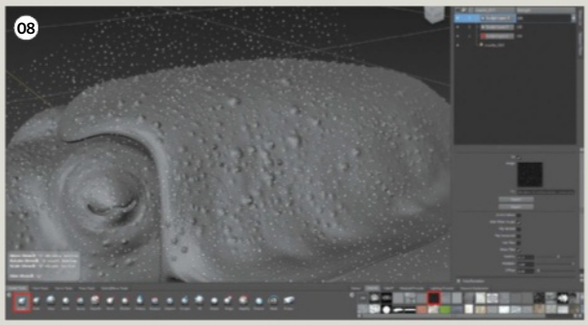
06 Export to Mudbox

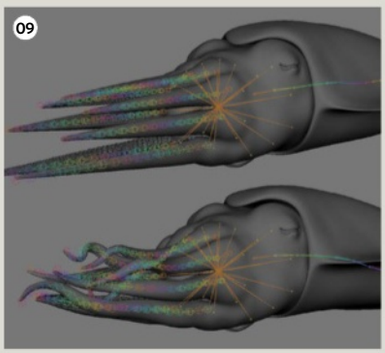
Before sending everything off to Mudbox, make sure the head is sealed at the back and also the inside of the mantle. By now we should have a head with the arms attached, a mantle and eight sets of suckers. Select everything and export it out of Maya as an FBX file and then import that file into Mudbox. At this stage, we will mainly be referring to the photographic reference images to create the final silhouette of the cuttlefish.





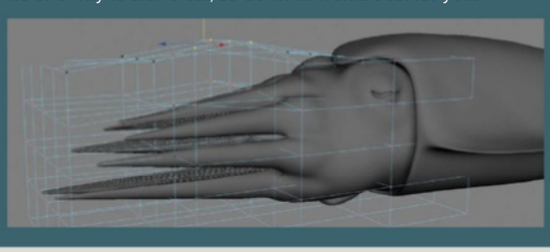






Use every tool at your disposal

As it's so easy nowadays to send geometry from one package to another, I think it's best to use every tool at your disposal – and by every tool, I don't mean just the modelling tools in software packages, but also animation, rigging and procedural tools. One of the reasons I like to go back and forth between Maya and Mudbox is that Maya has some fantastic rigging tools that can help to push forms that are not quite possible in sculpting packages. The Lattice Deformer in the Animation menu is a prime example. I find it quicker to pose geometry using the Skeleton>Joint Tool. It may just be my way of working, but it's worth experimenting with. Remember, there's no one way to skin a cat, so do what works best for you.



07 Sculpt the forms

With all the pieces in Mudbox, start by pushing the head further. First, subdivide the mesh a couple of times and then use the Wax brush to build up some areas and reduce form in others. Sculpt over the entire mesh very lightly to add some surface noise to the geometry and to break up the clean shape. Then, focus on the areas between each arm to create the webbing and give the arms a bit more volume with the Bulge brush. The mantle also needs some attention, especially around the fins. Again, the Wax brush should be used followed by the Smooth brush to work the forms back into the main mesh.

08 Add finer details

Once the major forms are in place, start to add the finer details on a higher subdivision of the mesh. At this stage, it's important to remember that we are creating an asset that is supposed to be alive and not dead. Therefore, we want to look at reference images of live cuttlefish, as opposed to the specimens that have been pickled for however long. The difference between the living and the dead is that a living cuttlefish has plenty of pimples on its surface, while the dead have plenty of wrinkles. For my project, I mainly relied on the Bulge brush to add the bumps manually and also the Sculpt brush with the bw_pores stencil that comes free with Mudbox. The Sculpt and Foam brushes will come in handy for the area around the mouth of the cuttlefish. It's pretty hard to find reference images of living cuttlefish showing this area, so I decided to contrast this region with the pimples on the outside by making it feel slightly more wrinkly.

09 Use joints in Maya for posing the cuttlefish

To test out if the arms have the right amount of volume when they come together, create a very simple rig in Maya. First, export the lowest subdivision mesh of the head, the mantle and the suckers from Mudbox back into Maya. Using the Joint tool, create a 15 joint to run down each arm and a few joints for the face and the mantle. Then, skin the head and the mantle to the joints. We will then skin the suckers onto the relevant joint chains so they will follow along. Next, rotate the joints into place to see if the arms close neatly. We will need to translate the root of each arm joint slightly to bring the arms together more snugly. The result is pretty good, but there may be a lack of volume in some of the arms still. The suckers cling on the arms pretty well when deformed, but hopefully we can come up with a desirable result later on during the rigging phase.

10 Fix in pose

What we want to do now is to fix the mesh in this pose and then be able to go back to the default pose with the arms pointing straight out. To do so, from Maya export each part of the cuttlefish out as an OBJ file while it's in the pose. Then in Mudbox, select the head mesh and go down to the lowest subdivision. In the Sculpt Layers window, click on the Options button and select Import Layer. Now select the exported posed body part for the head and click OK to the pop-up window that appears. You should now find that the mesh in Mudbox has morphed into that pose and you can scroll up and down the subdivision levels with all of the details intact. I ended up creating a new Sculpt layer with the mesh at subdivision three and then used the Bulge brush to fill out the forms and add further volume. You can enable and disable the Sculpt layer used to pose the mesh, letting you to go back and forth between the default pose and the new one. Once we're done tweaking, we should have a high-res sculpt and an animateable mesh. In the next tutorial, we'll create the UVs, the Normal and Displacement maps and also the Color and Spec maps. For now, it's fish and chips for dinner.

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- Custom brushes
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Skin surface techniques in ZBrush

"How can I create convincing skin details in ZBrush?"

In film VFX pipelines, a common method used to approach the creation of skin surface details is directly driven by the texture. Displacement maps for pores and fine wrinkles can easily be extracted from the Color map. However, this workflow can sometimes result in a flat look with not much variation in micro surface form. Thankfully, ZBrush allows these details could be applied directly to the sculpt. I prefer working this way for maximum control over the look of a 3D surface.

In order to achieve the desired effect, don't just flood the mesh with a poor texture. Pores vary in different regions of the face and wrinkles are not just random, but created by muscle tension and skin characteristics. Wrinkles are not simply cut in, but are rather sculpted like folds of cloth that hang due to gravity.

There are different ways to go about this, but we'll create a set of custom-made brushes and use standard Alphas that already come with ZBrush. We will start with a smooth base and build up details step-by-step, from big shapes to small details. First we will create the main wrinkles and folds that define the expression and overall shape of the face, then we will define what kind of wrinkles we need for different parts of the face. The next step will be the creation of the different skin brushes we need to achieve the desired effect, which we will apply on separate layers so it's non-destructive.

Paying close attention to the micro details of the skin, we will add further skin layers and skin direction, focusing on veins and other imperfections. We'll also perform a detail pass using ZBrush Noise Maker.

Along with this tutorial, you will find that the orc base mesh has been provided with the issue, which you can use to follow the tutorial throughout. The basic forms of the orc's head are established. The Pore brushes that I created can also be found with the issue. You don't need to create an exact copy, however – the idea is to sculpt a skin quality that is rough, dry and has a robust feeling to it to suit this orc. Go online and search for reference images that exhibit these qualities. These will help you achieve a look and feel of your own.

01

Blender, Cycles

Gleb Alexandrov
www.blender-game.com

CG artist, indie game developer and Blender enthusiast. Here, Gleb Alexandrov shows us exactly how to create realistic-looking grass in Blender. Check it out on page 88!

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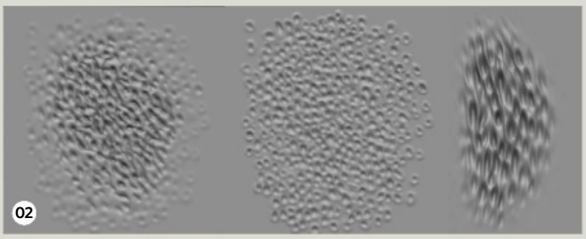

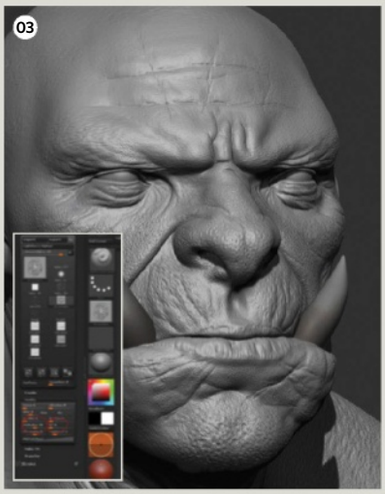

01 Build wrinkles and folds

Reference is key here – use a mirror to examine your own expression and how the wrinkles fall into place. It's worth searching the web for pictures of old faces for this sculpt. We want to end up with a skin quality that is rough and dry. When creating wrinkles, don't just cut in. Build up the form with the Standard and Clay Buildup and Inflate brush using a low intensity, then cut in under the volume where you want to have the crease. Wrinkles that are not pulled up by muscles hang down due to gravity. You can try and use the Gravity strength on the Standard brush under Brush>Depth to help the effect. To cut in, use the Dam Standard or Standard brush with Alpha 38.

02 Create custom skin brushes for imperfections

We need different pore types for different areas. Deeper pores are located on the forehead, the cheeks under the eyes and on the nose. Create a plane in ZBrush and subdivide it a couple of times. Now sculpt a few pores. Cut in, but also build up form. Look at your reference and sculpt three different versions for types of pore. Now create a document that is 1000x1000px in resolution. Fill the document with the pore plane you just created and click on the Alpha selection field and then on GrabDoc. Now you can use this Alpha with the Standard brush and DragRect to apply your pores onto the surface.

03 Apply custom skin brushes

When you apply the brush you will notice that it stamps the rectangular border of the Alpha as well. You will need to adjust the MidValue of your Alpha and apply a bit of Radial Fade to get rid of this effect. You can find these settings under Modify in the Alpha menu. Apply your new brushes according to your reference and split them up into layers for better control. This way you can easily adjust the strength of each pore set. Use a Morph Target without pores and the Morph brush to dial back the details in specific areas.

04 Include further skin layers

Make use of the tools ZBrush offers out of the box. The Standard brush with Spray Stroke and alpha07 can add some additional variation, and if you try the same brush with alpha25 you'll get a subtle skin effect. Through motion and dryer skin, over time micro wrinkles will develop. These wrinkles follow a certain direction. Save a Morph Target and create a new layer. Use the Standard brush with a Low intensity, Spray Stroke and alpha58 to apply skin direction. Dial down the Flow output of the spray to 0.1 to get a less harsh effect, using the Morph brush to smooth the result with other layers.

05 Add skin imperfections

Create a new layer for imperfections. These can be scars, scratches moles and skin irritations. We can also put veins into this group, but add an extra layer for these. You can get creative here, but less is more. It's a good opportunity to break up the symmetry to achieve a more natural look. Like in step two, you can create different custom brushes for any kind of imperfection, though you may find it easier to sculpt by hand.

06 Employ Noise Maker

The Surface Noise feature is a great tool to create additional skin detail breakup or a base for your pore layers. It is a procedural algorithm and does not necessarily require UVs, so it's good to use on a quick DynaMesh base topology. It is mostly used to create surface details for rocks, but if you push the scale to the lower values and play with the Noise Curve you can achieve subtle skin roughness results. The Noise Maker previews your work in a separate window. You can mask the areas of your mesh that you don't want to be affected by the noise and commit it to your model.

Support for the texturing process

Now that we've sculpted all the fine pore detail, it will be difficult to line up the Color maps with the sculpted micro details by hand. Because we have all the major skin types, veins and imperfections on different layers, we can isolate these layers and export individual Cavity maps. Turn off every layer except the ones you need to make the Cavity map from and export them using the Multi Map Exporter. You can use these individual Grayscale maps as masks for the texturing process.

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Blender, Cycles

Realistic grass in Blender

"How can I make realistic wild grass from scratch by using the particle systems in Blender?"

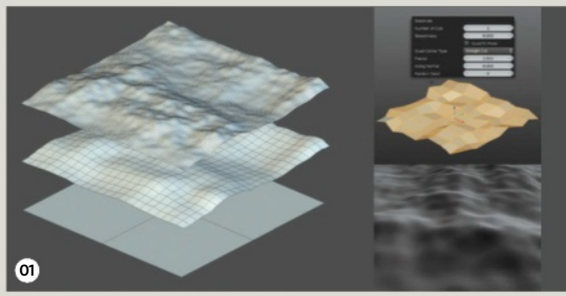
There are several ways to deal with highly chaotic systems like grass in Blender. One method would be to use a Displacement modifier and plug in a noise texture to fake the grass look. Another method is to use DupliVerts and to play with the polygon density of the base object. You could also use the Grease Scatter add-on. Of course, there is always a possibility of using a brute-force method of placing individual grass clumps by hand. It's worth noting that unfortunately, none of these methods are both fast and non-destructive, nor do they enable us to fully control all of the features of our grass population.

In my opinion, the best method for grass is to use a particle system along with particle textures. This opens the door to a fully procedural workflow and provides the widest array of creative possibilities.

There are several stages that must be mastered to follow this process. These stages involve the modelling of a Distribution Object, creating particle systems, then designing the distribution patterns and shading, lighting and rendering. In other words, we'll be using particle systems to scatter grass clumps on the surface of a ground plane, according to procedural distribution patterns. The final result should be a complete picture of a wild grass meadow in Blender.

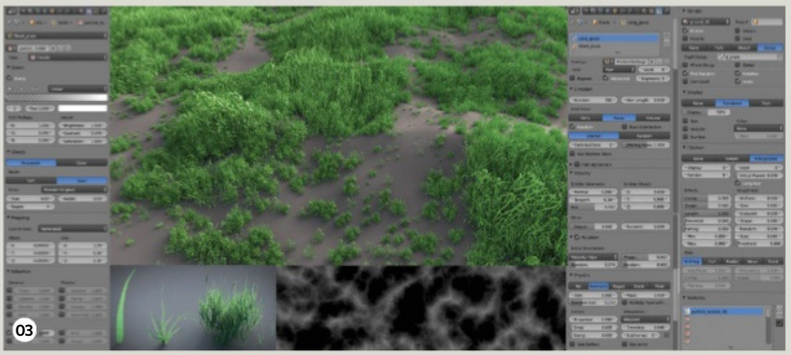
To clearly demonstrate the basic principles of grass creation we're going to build everything from scratch. We'll start with a ground mesh and then make a Distribution Object, which will be our grass clump. From there we'll move on to particles and establish two types of population – short and long grass. After that, we'll set up lighting and materials. During this stage of production we'll edit the overall look and feel of our picture using various lighting and shader-blending techniques. The final step will be rendering and post-processing.

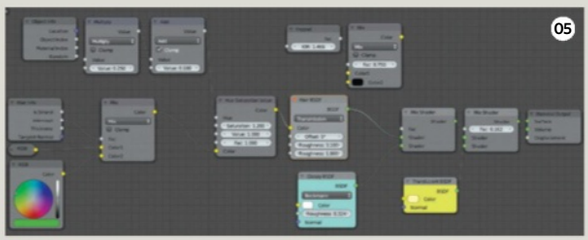
Alternatively, we could scatter individual grass blades. Personally, I think that this method is best for a lawn type of grass as it tends to produce homogeneous cover. For now, let's stick to grass clumps for various reasons. First, when previewing particles in the Blender viewport, it's better performance-wise to have a few objects with a higher polycount than a lot of low-poly ones. Second, we're going after the look of a wild grass, so it's easier to achieve this look using defined, custom-shaped clumps. You'll find the tutorial scene file supplied with the issue.



01 Build a ground mesh

To create our basic object, let's start with a plane. Go to Edit mode, select all polygons and subdivide it a few times to make roughly 19k faces. After each subdivision, activate Settings and tweak the Fractal function. This adds procedural noise to the subdivided geometry. Another way to shape an organic form from the plane is by using a Displacement modifier with a Musgrave texture. Alternatively, you can just activate Proportional Editing mode, tweak falloff and start moving the vertices – choose whichever best suits your workflow.





Randomness in nature simulation

Randomisation is incredibly important when simulating nature. If an image contains elements that are quite obviously similar, then it breaks the photoreal illusion. With this in mind, it's worth taking the time to add randomness to various parameters, such as scale, rotation and colour so you can break up any visual repetition. For the same reason, it's good to include other kinds of particle systems when creating grass. This ranges from stones, branches and fallen leaves to flowers, weeds and shrubs. You can even scatter a few creepy-crawlies or animals around. Basically, every unique detail adds value to the overall scene.

02 Create a grass clump

Once again we'll start with a plane, add a few Loop Cuts with Cmd/Ctrl+R and move the vertices to shape a grass blade. Once it's ready, make a few copies and apply some unique features to them. The simplest way is to rotate and scale the blade and to change the bend a little. Now that we have a small grass clump, let's copy and place it in such way that it forms a larger clump. This process can be repeated until we have 3k to 6k polygon clumps, though the polygon count should depend on the distance between the viewer and the grass and the technical specifications of your computer.

03 Add particle systems

For this task we'll use Hair particles. The choice between Emitter and Hair is based on a personal preference, though both types can produce great results. Nevertheless, a Hair particle system is slightly easier to set up because it's static and nothing needs to be tweaked to make it stay in one place. When using Emitter, we should set all the Velocity and Gravity settings to 0 and then set the Start and End time of the emission to the same frame. To make things simpler, let's divide the grass into two groups – long, fresh grass and short, dry grass. Start with a long grass by adding the particle system of the Hair type. We'll need to set the Particle texture to Procedural noise, for example Cloud. Set it to influence the length of the hair. To make the edges of the grass population more defined, set the type of the Cloud noise to Hard. Tweak the Size, Brightness and Contrast to see how it affects the particle system. Note that we need a pretty high number of particles to see the effect clearly. Let's move on to the short grass by applying similar particle settings, with exception to the Size and the Particle texture. The size should be lower and the Particle texture should be inverted. This can be inverted by using Color Ramp and changing the position of sliders.

04 Set up the scene lighting

For the lighting, let's use a range of Sun Lamps, each set to different sizes. This way, we will preserve the lighting nuances on the grass blades, while at the same time softening the look and adding some ambience to the lighting. Set up four Lamps, each Lamp set to sizes 0.1, 0.5, 1 and 2 respectively. Try tweaking one lamp at a time to see how it impacts the shadows and the highlights – the Lamp with the Size set to 0.1 will produce the sharpest contrast, while the Sun Lamp that is set to a Size of 2 will add a strong ambient element to the lighting. Turn on all of these Lamps and make any final tweaks to the overall lighting balance. Using this setup, we almost don't need to use an environment texture or an HDR image because our lighting is already quite soft.

05 Tweak material settings

One of the defining characteristics of the grass material is translucency. Here we have positioned our Lamps near the horizon to achieve the look of sunset. Because our grass is lit from behind, it should absorb the light rays and emit a glow. Mix the Diffuse node or the Hair node with the Glossy node using Fresnel set to 1.5 as a Mix Factor, then mix the resulting material with a translucent shader, with the mix value set to around 0.3 to 0.7. Note that the Mix Factor between these two shaders strongly affects the visual character of the grass. Take note that the Roughness value in the Glossy and Diffuse shaders has a big influence on how wet the grass will appear.

06 Render and post-process

For your final render, light bounces should be safely limited to 1. In this particular case, adding bounces doesn't affect our scene too much. Remember, the lighting is set up in such way that it's recognised by Cycles as a direct light – a Sun Lamp set to Size 2.0 serves as the ambient lighting. The last stage is the post-processing of the render. It can be accomplished to some degree in the Blender Compositor, but you may consider using an external image editor such as Photoshop. If you want to emphasise the glow, do so by creating a duplicate layer of the render and blurring it, then setting this layer's blending mode to Soft Light.

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Set extension in NUKE

"How can I build a basic set extension using NUKE?"

In this tutorial we'll use NUKE to learn how to build a basic set extension, utilising a basic pipeline that is used for doing almost any kind of set extension. This generally encompasses many elements of extension, from replacing a sign in a scene, all the way to extending or replacing buildings or objects. It's possible to achieve these effects through various methods.

Set extension is one of the invisible visual effects that we often experience in films without even realising it. Lots of shots are filmed on a partial set surrounded by green screens, which are then completed with CG extensions that look amazingly realistic, blending in with the real elements. Sign replacements are sometimes done in post-production as well.

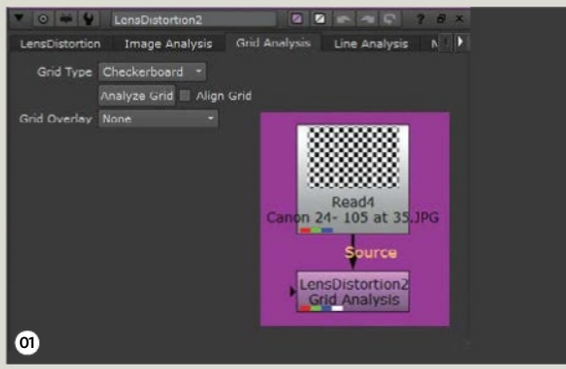
To develop our understanding of the fundamentals, we'll explain here how to replace a sign on the bus. Two sample textures have been provided with the issue for you to choose between. We will take a 3D approach to prepare the footage for tracking, explaining how to undistort the footage and degrain it for better tracking. We'll also explore some of the parameters of NUKE's 3D Camera Tracker which will help us better understand the 3D environment. We'll also use 3D cards for projections in NUKE.

The main goal of this tutorial is to develop a basic understanding of NUKE's 3D Camera Tracker and its uses for set extensions. Upon completing this tutorial and having replaced the sign in NUKE, you should have a good foundation of knowledge that you can expand upon for doing any kind of set extension using the 3D Camera Tracker. A similar method could be applied to any replacement on a building. This even goes for bigger scenes, such as an extension of a street, which would need us to model complicated geometry and then bring it into NUKE, depending on the shot.

While the same results can be achieved by using the 2D or Planar Tracker, our reason for using the 3D Camera Tracker is to better understand the 3D pipeline. This is much more useful when it comes to doing bigger set extensions and using camera projections to modify or replace objects, or when working on larger environments.

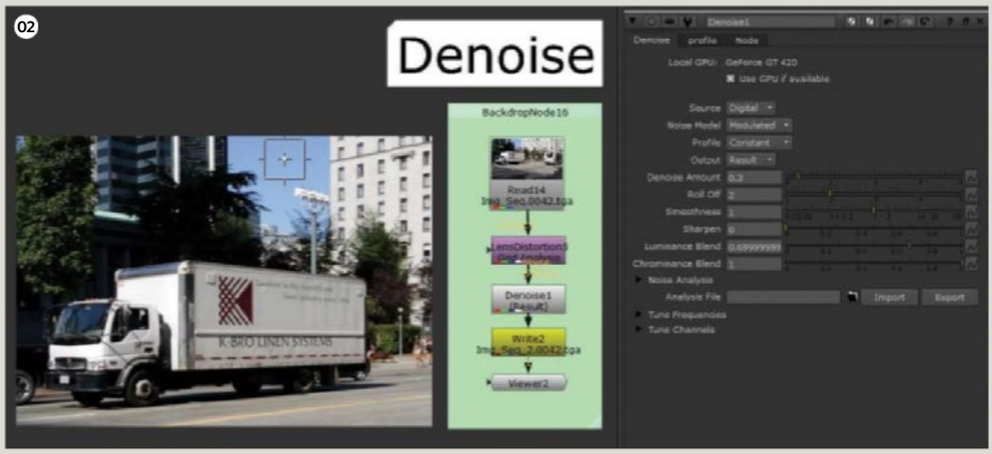
01 Avoid distortion

We can undistort a plate using three different methods – Line Analysis, Image Analysis and Grid Analysis. All of these are good methods, but it depends entirely on the shot and on how much camera information we have available to decide which method to use. In this shot, a Canon EOS 5D Mark III with a 24-105mm lens was used, so we can use the grid provided to start a Grid Analysis to undistort the plate. Undistorting the plate is vital because the Trackers move differently in the middle than they do towards the sides.



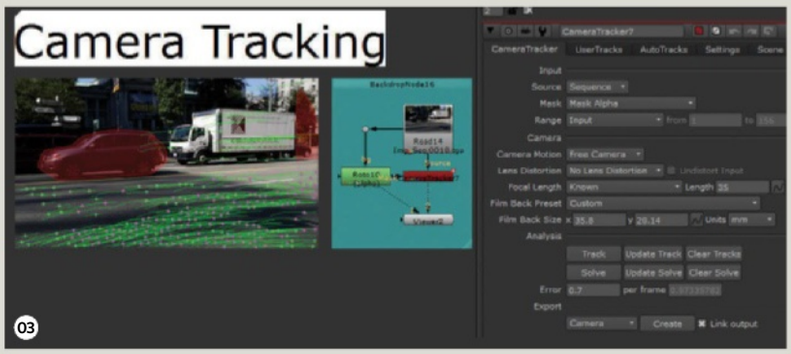
02 Degrain the plate

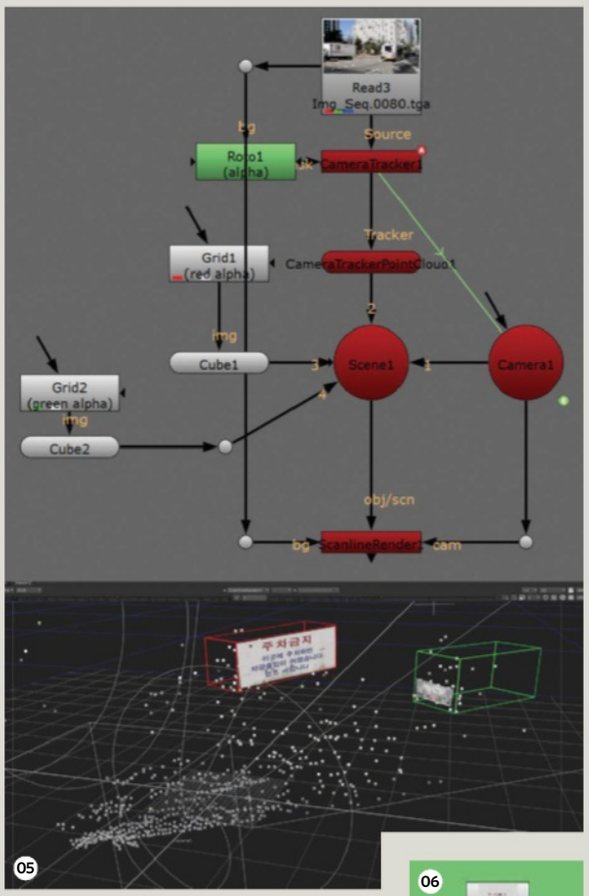
Removing grain is vital to achieving a better track. We can put the grain back into the finished shot to make sure there's a uniform grain. We'll use a Denoise node to take out the grain. Change the source to Digital, since this footage was shot on a digital camera, then change the noise to Modulated. Next, plug both the noise and source into the footage and use an area with less detail to sample the noise so that you don't lose any details in the image.

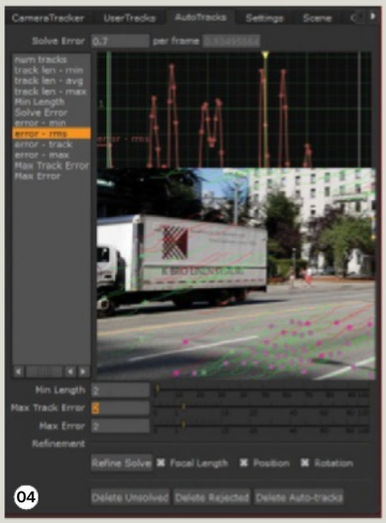


Useful tips

This tutorial's project files are compatible with NUKE 8 or above. When tracking using the Camera Tracker, watch out for moving objects and reflective surfaces, as they might interfere with the process. Before you begin, do a quick roto of whatever you think may hinder the Camera Tracker and then fill in the camera's data carefully, including Focal Length and Film Back Preset. If you don't know the focal length, the Tracker will estimate it for you, which you can use for Lens Distortion. Alternatively, you can calculate it using Image Analysis.







03 Use the Camera Tracker

We will need to do roto for all the moving objects so we can avoid moving tracks. In this footage, some of the cars and people are moving, so we will just roto them roughly. Plug this roto into the Camera Tracker as a Mask. Set the Mask to Mask Alpha so that the Tracker avoids tracking these areas. Since we have all of our camera information available, we will change the Focal Length to Known and set it to 35mm, and we'll change the Film Back Preset to Canon EOS 5D Mark III video. We can then increase the number of features to 500 and start tracking.

04 Refine the tracks

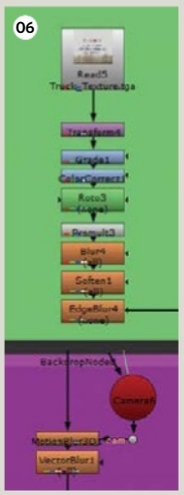
Once you have tracked the shot, click on Solve Camera, which will automatically calculate the Solve based on the camera details that we previously input into the Tracker. Next, we need to refine the tracks until we have a steady and reliable camera track. To do this, we'll use the AutoTracks tab in the Camera Tracker. We can use all the parameters provided in this tab to separate out the good trackers, then we will refine the Solve to update the Tracker. For example, you could change the Minimum Length parameter to a higher number and then delete the rejected tracks , which will offer better results.

05 Place the cards and plug in the textures

Once you are satisfied that you have a steady camera track, select the tracks on the ground and then Ctrl/right-click them to set them onto ground. Next, choose Scene from the Export menu under the Camera Tracker to create the scene, camera and the point cloud. The point cloud is an informative presentation of the tracked scene in the 3D space. Place cubes in the point cloud information where the bus is located, and then check in the 2D Viewer to see whether the perspective feels right. Once you've completed this, you can create Cards and place them in the scene, and then plug in your chosen textures.

06 Start grading and add some Motion Blur

Once all of the Cards have been placed and the textures have been plugged in, the final step is to do a quick roto before plugging in a Card to mask out the extra area, if you deem it necessary. Once this is complete, grade the textures and colour correct them so that they match your plate. Soften and blur the Output by a little to blend it into the scene and then apply the Camera Motion Blur. This is done by plugging the camera into the 3D Camera Tracker to create Motion Vectors and then using those in the Vector Blur node.



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I made this...

Incredible 3D artists take us behind their artwork

Artist info

Matt Tkocz

Website www.mattmatters.com
Country USA
Software used MODO, Photoshop
Bio Matt studied at the Art Center College of Design. Following graduation in 2012, he now works in the entertainment industry

Bullfrog: Mountain Rescue 2013

This mech was created as part of my contribution to the latest instalment of the *Nuthin' But Mech* book series. When deciding on the direction of the design, I didn't want to make yet another random war machine. Instead, I went with this walker concept, which has the very specific purpose of finding and saving lost or injured mountaineers.

> The Bullfrog is made up of various elements that can morph and change to perform a wide range of different functions

Group test: Monitors

REVIEWS BY Orestis Bastounis, technology writer, UK

Regardless of their field, one of the most valuable tools for any artist is a high-quality display. Whether you work with Maya, 3ds Max or Photoshop, your computer's display is the connection between your creativity and the technology you use. Along with your workstation, it's your most important peripheral.

It's logical to have the best and most accurate display your budget can stretch to, which is why we've reviewed four colour-accurate professional displays.

A

Dell UltraSharp 32 Ultra HD Monitor UP3214Q

Dell's latest wide-colour gamut monitor is an absolute beast in every sense. Its physical weight, dimensions, specifications and price tag dwarf many other screens on the market. Measuring 31.5 inches, it supports display resolutions up to 3840 x 2160, which in computing, is the resolution generally described as 4K, or Ultra HD. It's precisely quadruple the pixel count of a 1080p display, though 4K can also refer to other resolutions, such as 4096 x 2160 in digital cinema.

Despite this, it doesn't support DVI. Instead, you get DisplayPort and Mini DisplayPort and a single HDMI connector, but there are four USB 3 ports as well.

It uses a Sharp IGZO panel, as found in other current 4K displays. With such a big screen, you have a huge amount of desktop space – you can comfortably work with Photoshop, 3ds Max, a web browser and Skype all at once. Without increasing the DPI, text is fairly small at 4K, although it's less of a problem on a giant desktop monitor than it is on a laptop-sized screen. Increase the DPI and it looks much better, although some icons and graphics still remain tiny.

This is the first 4K monitor that we've tested, and we ran into problems getting 4K to run at 60hz. At only 30hz, mouse movement and scrolling in web pages was uncomfortably choppy.

Touch-sensitive controls and a slightly fiddly on-screen menu system contain plenty of settings and colour presets, with AdobeRGB and sRGB present.

At the native setting we found the UP3214Q beautifully vivid, with 380 cd/m2, making it one of the brightest screens we tested. The colour coverage is outstanding, as expected from a professional monitor. 100% sRGB, 99% AdobeRGB and 96% NTSC puts the UP3214Q on the level of EIZO's panels.

Unfortunately, it does suffer in a few other areas. We measured uneven brightness from the panel, from anything between 5 and 10 per cent in some corners.

Would we buy one? The Dell UP3214Q is a great, high-quality, colour-accurate display, but it's not the absolute best. Given the high price and the difficulty in getting 4K to run successfully at 60hz, we would advise those keen to wait it out for the next generation of 4K displays instead.

Essential info

Price: £2,299 / $3,500 US
www.dell.co.uk

TECHNICAL SPECIFICATIONS

- 3840 x 2160 native resolution
- 16:9 aspect ratio
- 10-bit colour display
- IGZO IPS panel
- Inputs: HDMI, DisplayPort, Mini DisplayPort, 4x USB 3
- Dimensions with stand (WxHxD): 750mm x 572mm x 51mm
- Weight: 16kg (including packaging)

B

The good & the bad

- ✓ 4K native resolution
- ✓ Excellent sRGB and AdobeRGB coverage
- ✗ Difficulty in running 4K at 60hz
- ✗ Fiddly menus

Our verdict

Features	9/10
Performance	9/10
Design	8/10
Value for money	7/10

> The UP3214Q produces really bright, vivid and accurate colours with a full 4K display

Final Score 8/10

Asus ProArt PA279Q

The PA279Q is a 27-inch, 10-bit display with a wide-colour gamut and a 2560 x 1440 native resolution. It comes factory-calibrated with preset modes for sRGB and AdobeRGB.

The screen can be raised and lowered, rotated 90-degrees and tilted backwards. If you need it, the stand can even be removed and the panel placed on a VESA wall mount.

There's an all-digital array of inputs, with HDMI, DisplayPort, mini DisplayPort and DVI. A generous total of six USB 3.0 ports and a 9-in-1 card-reader are built in. Picture-in-picture mode lets you display two separate inputs at once, with a moveable and resizeable image in the corner.

Asus even supplies a monitor hood with the PA279Q, with a handy door on the side for easy access to the monitor's panel controls. There's also a measurement guide along the bezel on each side with both centimetres and inches – certainly quite handy for a 3D artist.

The menus are controlled with physical buttons and a small joystick for navigation. Pressing the joystick inwards brings up the QuickFit grid, which displays an on-screen alignment guide, again with modes for centimetres and inches, along with A4.

The panel is an AH-IPS from LG, which is better quality than the usual IPS screen in consumer monitors. The specs list claims a delta E of less than two, 99% AdobeRGB coverage, 100% sRGB and 120% NTSC, with a brightness of 350 cd/m2.

Our testing showed these claims to be mostly accurate. We measured a brightness of 390 cd/m2, with a pleasing overall contrast ratio of 620:1. AdobeRGB coverage of 98% is close enough, with 95% NTSC and 100% sRGB. An average delta E of 1.42 is more than competitive.

The only area where the PA279Q slightly disappoints is in its brightness uniformity. When set to 100% brightness, the backlight shows consistent output on the lower section of the screen but deviates by around 18 per cent at the top.

Given the competitive price of the PA279Q, these results are very impressive. You could spend considerably more for an even better specification, but the PA279Q is undoubtedly a great choice for such a reasonable price tag.

Essential info

Price: £756 / $849 US

www.asus.com

TECHNICAL SPECIFICATIONS

- 2560 x 1440 native resolution
- 16:9 aspect ratio
- 10-bit colour display
- AH-IPS panel
- Inputs: HDMI, DisplayPort, DVI-D, 6x USB 3
- Dimensions with stand (WxHxD): 640mm 559mm x 240mm
- Weight: 10kg (including stand)
- 2x 3W speakers

The good & the bad

- ✓ **High sRGB and AdobeRGB coverage**
- ✓ **QuickFit on-screen alignment guide**
- ✓ **Joystick for easy menu navigation**
- ✗ **Irregular backlight brightness at the top**

Our verdict

Features	**9**/10
Performance	**9**/10
Design	**9**/10
Value for money	**10**/10

> The PA279Q punches above its weight, with colour reproduction that rivals more expensive displays

Final Score 9/10

D

A The Dell UP3214Q is the only screen in this test featuring a 4K resolution, though it struggles at 60hz

B Unfortunately the UP3214Q suffers from uneven brightness, particularly in the corners of the screen

C Like the others in this test, the Asus ProArt PA279Q has an adjustable screen and can even be wall-mounted

D The monitor hood has a centimetres and inches guide along the edges of the screen for extra ease when working

Is 2014 the year of 4K?

Unlike 3D televisions, 4K displays will soon be flying off the shelves. Although the difference between 1080p and 4K is more subtle than the difference between standard and HD, it's something people will notice, particularly when you focus on small details.

The sheer number of pixels in a 4K display causes problems, though. Refreshing over 8 million 10-bit pixels 60 times a second requires a massive amount of bandwidth, meaning older connectors such as DVI are ready for retirement.

Even DisplayPort and HDMI have problems. Until the 2.0 spec is released, HDMI is limited to 30hz output. With DisplayPort, you can reach 60hz, but it has to be done in a convoluted manner, using multi-stream transport, where each half of the screen is catered for by a separate DisplayPort signal. Even DisplayPort 1.2 has problems. Version 1.3, coming later this year, should resolve this issue.

There are also software problems with both Windows and Mac OSX. Similar to the DPI issues we encountered when using the high-res WQHD+ screen in the Dell M3800, in Windows you may find that text and icons appear too small to read. The same problem can happen with older Mac software, along with issues with font rendering, though Apple's 10.9.3 update will improve support for 4K.

Given the lack of content, the high prices and software problems, we're not sure that 4K is ready just yet. If you can wait it out a bit longer, there will be a wider range of displays with DisplayPort 1.3, significantly better software support and lower prices towards the end of the year.

E

ViewSonic VP2772

Essential info

Price: £604 / $1,020 US

www.viewsoniceurope.com/uk

TECHNICAL SPECIFICATIONS

- 2560 x 1440 native resolution
- 16:9 aspect ratio
- 10-bit colour display
- GB-LED panel
- Inputs: HDMI, Mini DisplayPort, DVI, 4x USB 3
- Dimensions without stand (WxHxD): 642mm x 381mm x 56mm
- Weight: 8.54kg (including stand)

The good & the bad

✓ **High sRGB coverage**
✓ **Touch-sensitive controls**
✓ **Good value**

✗ **Middling AdobeRGB coverage**

At around £604 / $1,020 US, the VP2772 is an affordable 10-bit, 27-inch display from ViewSonic that outputs a native WQHD resolution of 2560 x 1440. It has a GB-LED panel, factory-calibrated, with sRGB and AdobeRGB preset modes. It rotates, pivots and swivels for portrait and landscape use.

Four touch-sensitive digital buttons on the lower-right of the bezel, labelled up, down, 1 and 2, are used for selecting inputs and navigating menus, but they take some getting used to. Depending on the menu you're in, 1 usually means 'back', while 2 means 'select' with the arrows used for moving through lists, though not always. Switching inputs requires pressing 2 multiple times, while accessing the brightness control needs three presses.

A gigantic base occupies a large amount of desk space under the monitor. The benefit is that it's especially sturdy, so the VP2772 always stays locked in its position.

The usual array of inputs cater for everyone – DVI, DisplayPort, Mini DisplayPort and HDMI, along with four USB 3 ports. For some reason, ViewSonic has opted for an external power supply, so you're left with an ugly brick under your desk, and you can't use any old kettle lead as you can with just about every other monitor.

As measured by our calibration tool, the colour space coverage wasn't as good on the VP2772 as other displays. 94% sRGB is good, but 73% AdobeRGB and 69% NTSC are disappointingly in the realm of displays aimed at consumers, though this is to be expected, given the more down-to-earth price.

Thankfully, the brightness and contrast levels were better. 338 cd/m2 is a high brightness level, and 540:1 contrast measures up well. The brightness uniformity is also reasonable. Most screen areas deviate by about 7%, with 9.2% on the left-hand side.

If what you're after is a colour-accurate display, then there are better options out there, but the WP2772 is still a good choice if your budget is limited.

F

Our verdict

Features	9/10
Performance	8/10
Design	8/10
Value for money	10/10

> The VP2772 is good quality and great value for money, but its colour space coverage is disappointingly middle of the road

Final Score 8/10

Datacolor Spyder 4 Elite

Correct colour calibration is touted as a must-have for digital photography work and printing, but it's a consideration for 3D professionals as well, especially if you work with multiple displays. If you've agonised over the small details when designing your work, you'll want to make sure that the colours on your screen come out the same, or as close as possible, when sending that work to a client.

This can be solved with a Spyder colour calibration tool from Datacolor. The unit is placed over your screen and compares red, green and blue, as well as brightness and contrast output, against a normalised value. It calculates the percentage of sRGB, NTSC and AdobeRGB colour space your display can produce and creates a profile, working with desktop monitors, laptops, tablets and even your living room TV.

Brightness levels and colour accuracy affect how you perceive an image, so with these values set too high, your design may appear washed out on another display. Before calibration, the Spyder 4 reads ambient light around your monitor and factors that into its calculations. The Elite version measures variance in brightness at nine different positions on your screen, calculating the average deviance overall.

Calibration is a mundane task, but you might be amazed at the difference it makes. We tested all displays with a Spyder 4 unit, which provided an accurate method to compare display performance.

E Despite its large and rather overbearing stand, the VP2772 weighs only 8.54kg, making it the lightest of the four tested monitors

F The VP2772 uses a large external power supply, which means you need to find enough extra space for it

G EIZO are renowned for their expensive products, though the CG277 is certainly worth the high price tag

H Similar to the other monitors, the CG277 can be adjusted and rotated from landscape to portrait, plus it comes with a hood included

EIZO ColorEdge CG277

EIZO displays have a long-standing reputation for superior colour accuracy, which has made them a popular choice for high-end photography work. Equally well-deserved is their reputation for being expensive. At £1,300, the 27-inch ColorEdge CG277 is definitely pricey, but with many other competitors now offering colour-accurate displays, it's no longer obvious that EIZO's higher prices are still justified.

The CG277 certainly feels like a professional product. A hood is included, which can be used in both landscape and portrait modes, and the entire display is physically larger than any consumer monitor we've seen. Clearly, EIZO doesn't even care about the race for ever-thinner bezels, but despite the extra size, the CG277 is surprisingly light and portable. It comes with the base already attached, and can be raised, tilted or swivelled like other displays.

When you switch it on, extra features become apparent that can't usually be found on monitors. The first is a self-calibration sensor that pops up briefly. EIZO says this eliminates the need for third-party calibration tools, which can be time consuming to connect and run.

The on-screen display also earns praise. Seven physical buttons occupy the bottom section of the bezel. EIZO has realised people often forget what function each one performs, so offers overlay text labels directly above the buttons on the screen – a great decision.

Unlike any other monitor we've tested, the brightness is not some arbitrary percentage figure, but accurately quoted in cd/m2. There's no simple contrast control, but as expected the settings include temperature, gamma, gamut and six-colour level controls. The preset modes include sRGB and Adobe RGB, but also more obscure choices such as EBU, REC709, SMPTE-C and DCI.

The colour accuracy trumped all other displays we've tested. With 99% AdobeRGB and 97% sRGB the CG277 achieved the best readings from our calibrator. However, the real benefit of the CG277 was its superb uniform backlight. The white levels deviated no more than 1.6% across the pane, while other screens can be as much as 20% dimmer in different areas.

Our overall impression is that EIZO still stands out from other display vendors in its commitment to the professional market. The CG277 isn't for gaming or movie viewing. It's for those who are willing to pay more for colour accuracy and features to enhance professional design work.

OUR TOP CHOICE

The Eizo ColorEdge CG277 comes out top in our tests

Essential info

Price: £1,300 (approx. $2,160 US)

www.eizo.com/global

TECHNICAL SPECIFICATIONS

- 2560 x 1440 native resolution
- 16:9 aspect ratio
- 10-bit colour display
- Non-glare IPS panel
- Inputs: HDMI, DisplayPort, DVI-D, 4x USB 3
- Dimensions with stand (WxHxD): 646mm x 425mm x 281mm
- Weight: 12.8kg (including stand)

The good & the bad

- ✓ Outstanding sRGB, AdobeRGB coverage
- ✓ Uniform backlight brightness
- ✓ Hardware calibration tool
- ✓ Wide range of colour gamut presets
- ✗ Expensive

Our verdict

Features	10/10
Performance	10/10
Design	9/10
Value for money	8/10

"The remarkable uniform brightness of the CG277 is the feature that makes it worth the price"

Final Score 9/10

EIZO's ColorEdge CG277 trumps the other monitors in the group test, proving its commitment to the professional market

Conclusion

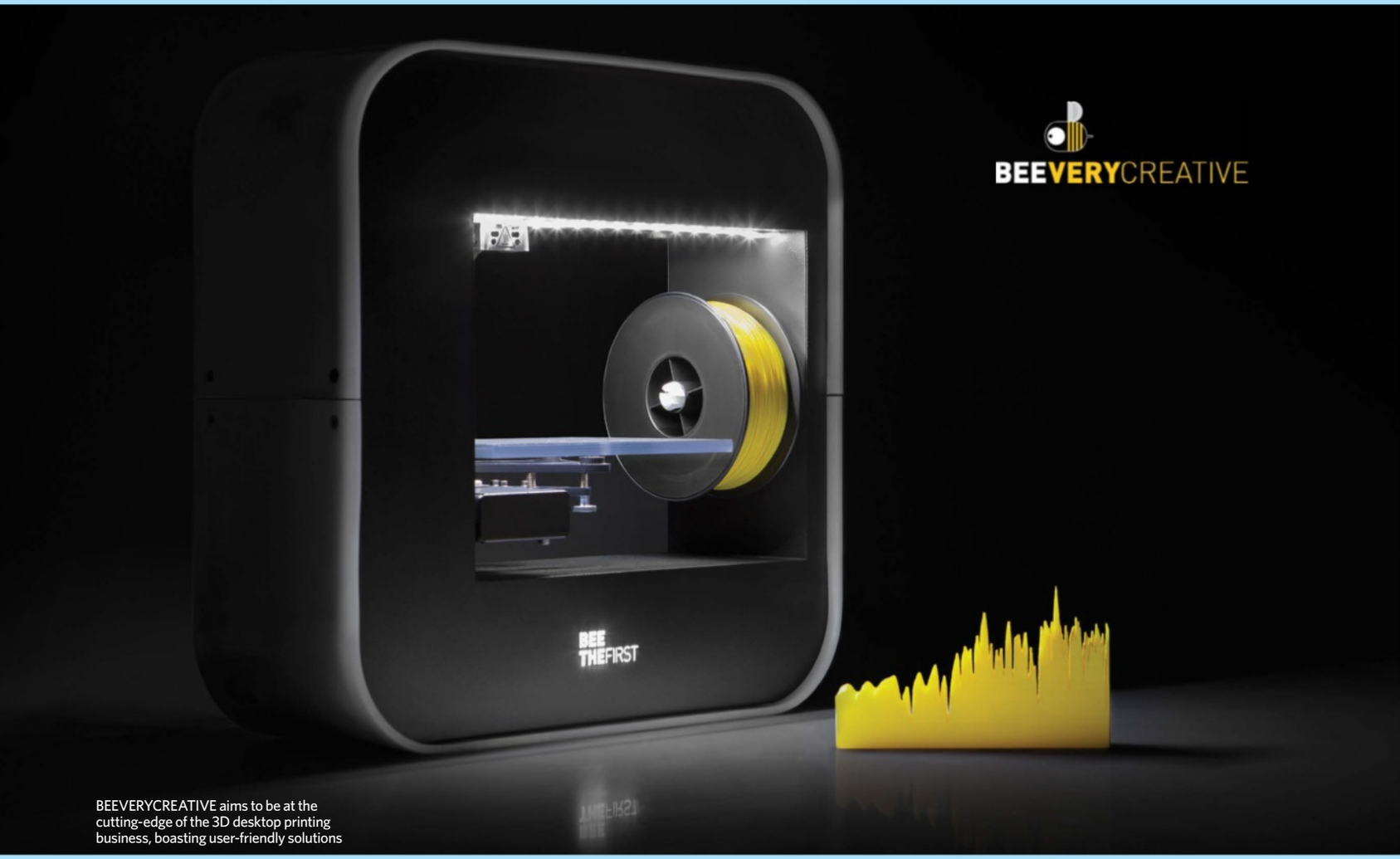
High-quality, colour-accurate monitors are falling in price, with ViewSonic and Asus applying pressure on long-established players in the professional display market. The VP2772 is a good display, but its overall colour reproduction was eclipsed by the outstanding sRGB and AdobeRGB coverage offered by the Asus PA279.

Dell's UP3214Q isn't just a 4K screen – it's an extremely good-quality, colour-accurate monitor for professional use. It is huge and provides a lot of desktop space. It might make sense to replace a dual-monitor setup with a single 4K display, but 4K displays at this point in time have their downsides, besides the considerable expense.

On a budget, we'd pick the Asus PA279Q. It isn't the absolute best display we've used, but it's very good, has useful extra features for graphics professionals and costs half the price of the EIZO. Indeed, it's not much more expensive than a typical consumer 27-inch monitor.

However, if money were no object, we'd open our wallets and shell out for the EIZO ColorEdge CG277. The colour reproduction is superior to other displays, it has the best interface we've seen on a monitor and the uniform brightness of the backlight is where it really shows its value as a professional display. It's simply untouchable. Calibration is a mundane task, but you might be amazed at the difference it makes.

All displays were tested using a Datacolor Spyder 4, which offered an accurate way of comparing display performance.



BEEVERYCREATIVE aims to be at the cutting-edge of the 3D desktop printing business, boasting user-friendly solutions

BEETHEFIRST 3D printer

With exceptional design and ease of use, this is a 3D printer even beginners can master

REVIEW BY Larissa Mori, 3D Artist magazine

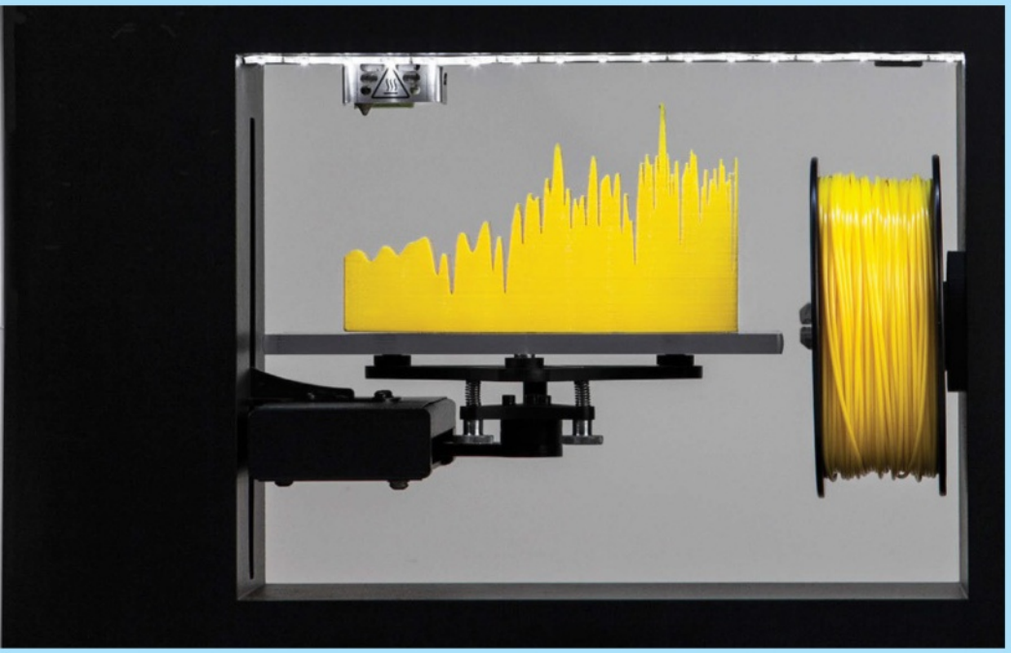
As 3D printing becomes increasingly popular among tech heads and technophobes alike, it's no surprise that simpler options such as BEETHEFIRST are starting to garner a lot of attention. Developed by Portuguese company BEEVERYCREATIVE, the printer is the result of efforts to create a 3D desktop printer that is reliable, beautiful and easy to use – a perfect set up for those who may be inexperienced with the technology.

The design of the printer was immediately appealing, even when seen across the room at the 3D PrintShow in London. When unpacking, things are no different. With an appearance more akin to the latest gadgets than a daunting machine, the BEETHEFIRST printer has been designed to look very sleek indeed. This attention to design doesn't seem to have come at the expense of practicality, either. With a sturdy metal frame, this printer is strong and durable, and has been specially created with portability in mind thanks to a handle built into the top. On purchasing your BEETHEFIRST printer you will also receive a host of perfectly packaged tools to help you start printing, including a coil of black 1.75mm PLA filament, a kit that contains a spatula, a pair of tweezers and a roll of tape for the printing table, an Allen key and any necessary power and USB connection cables.

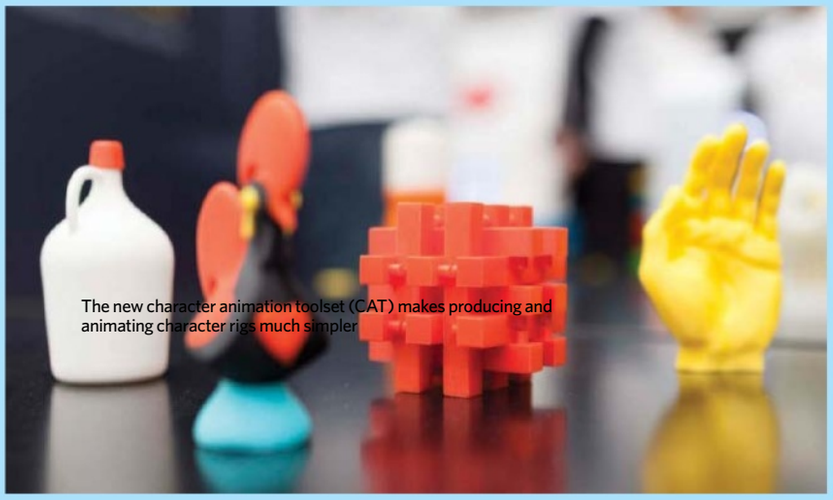
The BEETHEFIRST printer simply needs to be removed from its packaging and after a few minutes of setup and the installation of its software, BEESOFT, you're ready to work.

Compatible with a wide variety of operating systems, BEESOFT has been designed with a comfortable, easy user experience at its core. The printer has only two print quality settings to choose from; high or low, and BEESOFT guides the user through everything from table calibration to filament loading. Additional support comes in the form of a range of tutorials on the BEEVERYCREATIVE website. Of course, the lack of customisation that the software offers may be limiting for more experienced, technical users.

To anyone intimidated by the task, however, BEESOFT makes the process simple. With a 100-micron resolution at high setting BEETHEFIRST is on par with any other high quality desktop 3D printer in use today. The only limiting factor is the printer's build size, which is smaller than some of the competitors. Another limit is the fact that it's only optimised for PLA. Any PLA filament that isn't obtained from BEEVERYCREATIVE is not



Sustainability is important to the BEEVERYCREATIVE team, with BEETHEFIRST designed to print using the more environmentally friendly PLA

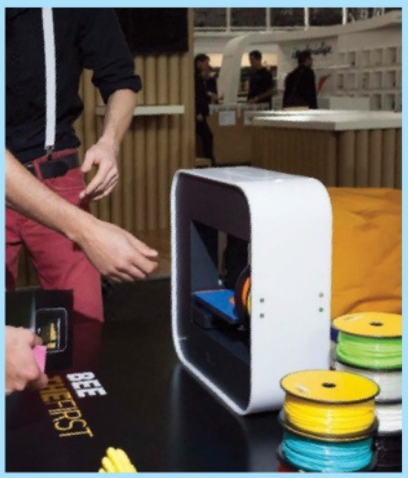


The new character animation toolset (CAT) makes producing and animating character rigs much simpler

BEETHEFIRST is currently distributed to all countries in the European Union. It will be available in other continents at a later date

recommended, restricting users to the colours and prices of €17 or €14 per spool on the official website. These spool prices are relatively competitive, however, and though PLA may be relatively restrictive, it's worth noting that this is a more environmentally friendly plastic as it's obtained from renewable resources, it's biodegradable, and it requires less energy to be extruded.

Although some might find the price of this printer to be too upscale, it is a remarkable machine regarding both ease of use and design. BEETHEFIRST prints quietly at a high resolution; is very simple to set up – even for a 3D printing novice; and will look impressive in any living room. For those daunted by the difficulties of 3D printing today, this portable new device may be just the solution we've been waiting for.



With few options to tinker with detail, density or specific support structures, BEESOFT may be restrictive to those used to experimenting

Essential info

Price: €1,990 incl. VAT

www.beeverycreative.com/en/beethefirst

OPERATING SYSTEMS

- Windows Vista, Windows 7, Windows 8, Linux Ubuntu 10.04 or higher, Mac OS X 10.6 or higher, a 32-bit operating system

BUILD VOLUME 190mm x 135mm x 125mm
PRINT RESOLUTION 100 to 300 microns
PRINTER SIZE 40 x 40 x 14 cm
WEIGHT 10 kg
MATERIALS USED PLA

OPTIMAL SYSTEM REQUIREMENTS

- HDD: 220 MB free space
- RAM: 1 GB
- CPU: Dual Core 1.5 GHz
- OS: 32- or 64-bit

BEEVERYCREATIVE filaments come in a range of colours, including a transparent option

The good & the bad

- ✓ Well-designed, quiet, would look stylish in a home
- ✓ Easy to use, compatible with most operating systems
- ✓ Very user-friendly software. Enables you to easily set up printer and prepare models
- ✓ Two-year warranty in case of defect
- ✓ Portability
- ✗ Quite costly
- ✗ Software may be restrictive to those who want to experiment
- ✗ Lack of options with materials. Any PLA filament not provided by BEEVERYCREATIVE is not recommended
- ✗ Smaller print size than some competitors

Our verdict

Features	7/10
Ease of use	10/10
Quality of build	9/10
Value for money	8/10

"BEEVERYCREATIVE'S first 3D printer definitely achieves both the beauty and ease of use that the company aimed for"

Final Score 8/10

From pipeline management to final product, completing your project by using high-end solutions has never been easier

The Foundry's Production COLLECTIVE

The Foundry has jumped into the world of software bundling. Dave Scotland takes a look at its brand new Production COLLECTIVE

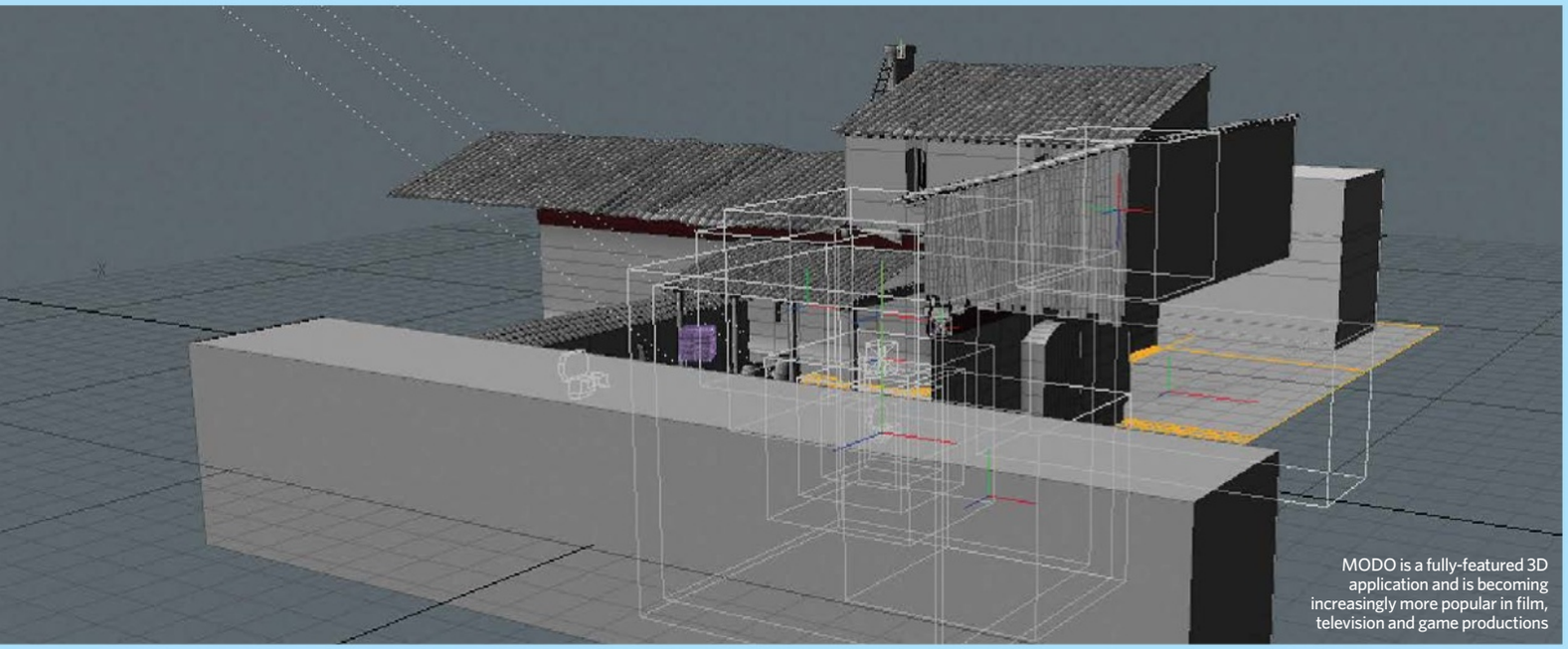
REVIEW BY Dave Scotland, 3D tutor

When it comes to bundled software, we are all familiar with the offerings from Adobe and Autodesk, to name just a few. The convenience and cost effectiveness of being able to purchase all of your tools in just one package has simply become an everyday way of life, especially if you are a freelance artist, student or operate a small to medium-sized studio.

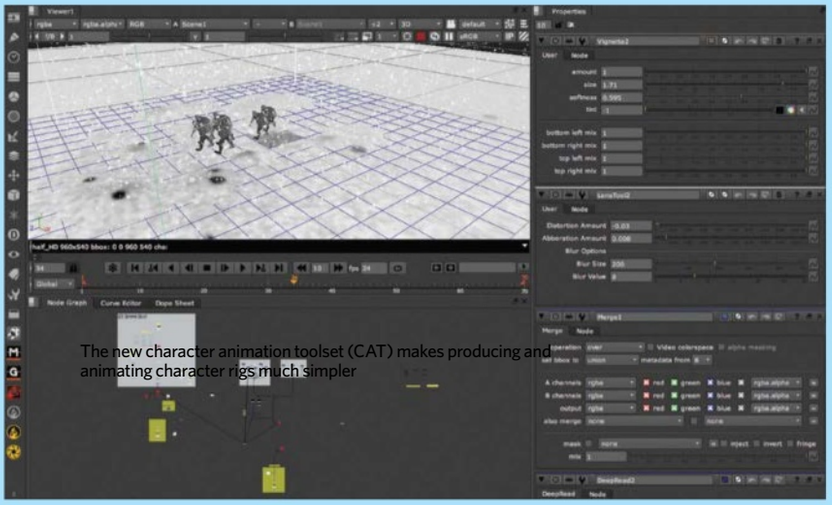
When it came to software published by The Foundry, you only had the choice of purchasing each title or licence separately. Very recently, however, that changed with the release of the new Production COLLECTIVE and the Creation COLLECTIVE. As a result of this, it is now possible for you to purchase all of The Foundry's high-end software and tools for one competitive price and under one licence.

The Production COLLECTIVE is made up of NUKEX, MODO, MARI and HIERO, while the light version, the Creation COLLECTIVE (retailing at £1,550 / $2,480 US), includes MODO, MARI and HIERO. Both of the packages are good value and it's great to have the option for a light version, but coming from a VFX, editorial and broadcast area, I was far more interested in testing out the Production COLLECTIVE.

Surprisingly, I found the install process a little old-fashioned. If you've installed software packages or bundles before, you would be familiar with the process of setting the parameters for all of the included titles and kicking off the install. Generally you would return a certain amount of time later to find a splash screen reading "Installation Complete". This is not the case for the Production COLLECTIVE. It happened to be a very hands-on process, with each title installing in almost exactly the same way that it would if you were installing them separately. I did feel that it could be worth addressing this in future releases.



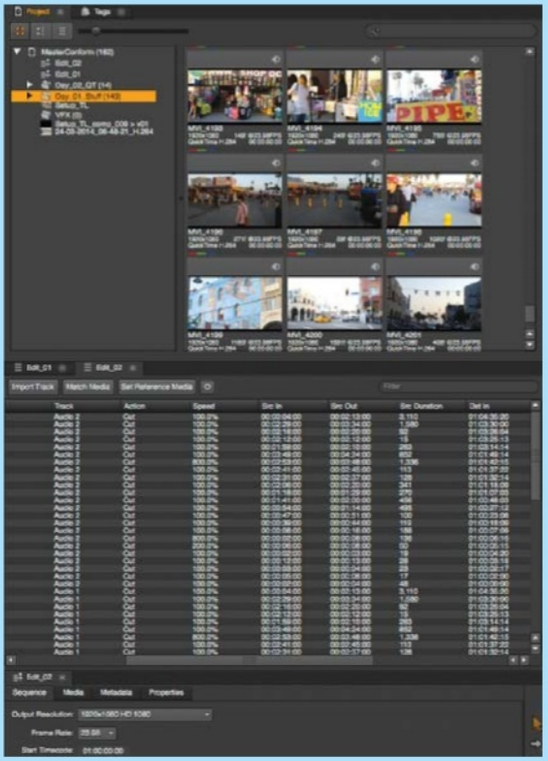
MODO is a fully-featured 3D application and is becoming increasingly more popular in film, television and game productions



The new character animation toolset (CAT) makes producing and animating character rigs much simpler

NUKEX has only just received a major upgrade, and all the new fixes and features are both brilliant and incredibly useful

As well as the Production COLLECTIVE, The Foundry is offering a light version known as the Creation COLLECTIVE, which includes MODO, MARI and HIERO in one bundle



HIERO is designed to streamline the shot review process, but it goes so much further that you might expect

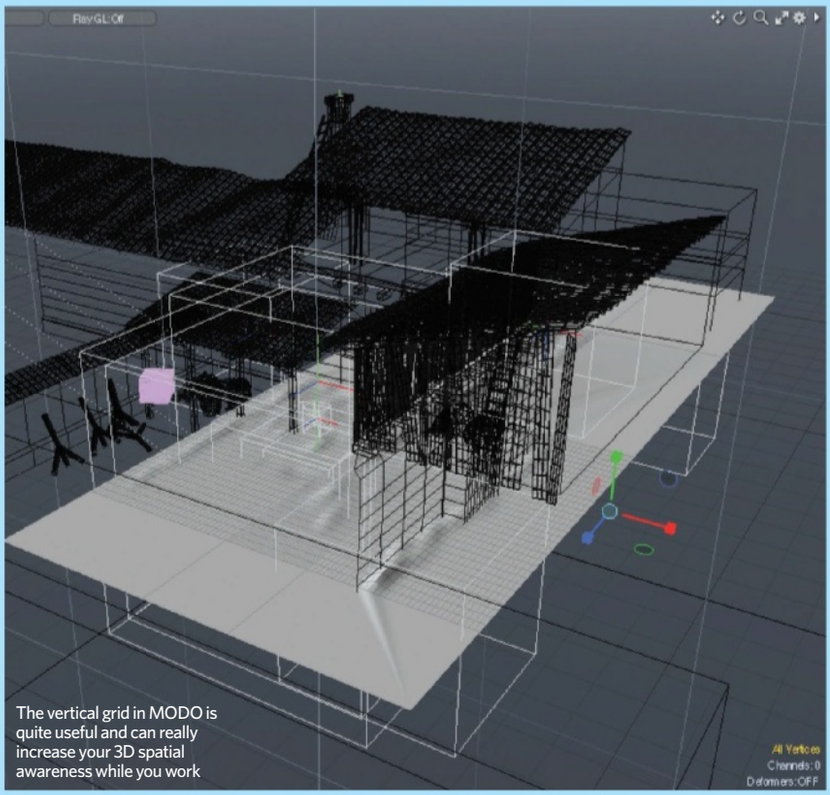
HIERO 1.8 Once the COLLECTIVE was fully installed, I started by setting up HIERO for a small test production. I found it easy to use and extremely powerful. This pipeline tool has been built from the ground up by The Foundry and the way it communicates with NUKE is nothing short of brilliant.

To call it a shot management tool is underselling its capabilities in the extreme. It has an excellent video-editing toolset and can also incorporate audio into its multi-track timeline. The powerful Tag and Export functions enable you to create and maintain an online or offline asset management and naming system. In fact, the Export system can even bake various nodes and input and output path settings straight into the NUKE file, ready for the artist – ideal for keeping the pipeline consistent and efficient.

MARI 2.5 Originally acquired by The Foundry after completion of *Avatar*, MARI is a cutting-edge 3D paint tool, which enables the artist to paint directly onto 3D geometry.

I was excited to put MARI's new Alembic file support to the test and found the toolset intuitive. I was impressed by the layering systems and found myself doing things that other software just can't do. The Physically Plausible Shaders gave some beautiful results and the layered masking offered the ability to refine my work in a very organic way.

I'm also very excited about the features earmarked for version 2.6. The HDRI based lighting and ability to easily flip between HDRI sources will certainly enthuse the game artists among us. The inclusion of Layered Shaders will also be a feature that no other software can boast. However, it's the



The vertical grid in MODO is quite useful and can really increase your 3D spatial awareness while you work

UV Transfer feature that has me most excited. It will give the artist the ability to transfer UV data from one model to another, for example, from a low-poly game model to a high-poly cinematic model.

MODO 701 A full-featured 3D application, MODO is certainly giving mainstream apps like Maya and 3ds Max a run for their money, especially with the integration of the new particle system. It had been a while since I'd used MODO, but I was pleased to see what had been added and what had been kept. I liked the Mesh Fusion feature set, especially given the flaky nature of booleans, so I think most 3D artists will find it very useful. The rendering capabilities, especially the real-time viewport features, were easy to use and yielded fantastic results. For past users or artists looking for a new skill-set, you could do a lot worse than MODO, especially given the increase in film, television and game use.

NUKEX 8.0V3 We recently reviewed the release of NUKEX 8 (Issue 65) and found it to be the best release of this award-winning compositing software so far. Whether it's the new Match Grade feature or the Intelligent Help System, you certainly need to try this version. There are new Text features, a Full Frame Player Buffer, a Particle Cache function and the 3D Camera Tracking has received a major overhaul. There's a new Scope System, which enables artists to assess colour using various modes of visual representation.

PRODUCTION COLLECTIVE Ultimately it is the individual applications within the Production COLLECTIVE that are extremely powerful. Despite this, the fact that you can now purchase them all under one licence can only mean greater accessibility to these incredible tools. The Foundry not only has a reputation for creating great, reliable software, it also has a wonderful connection to the creative community. This is evident through the tools it continues to release and without a shadow of a doubt, the Production COLLECTIVE is no exception.

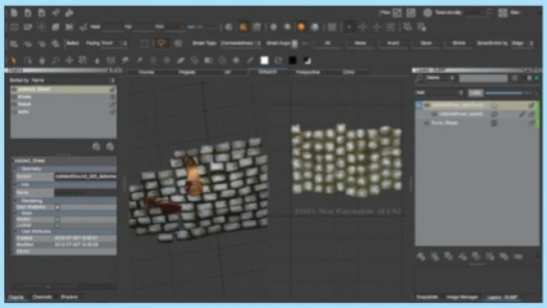
The installation process is quite simple, although slightly more hands-on than the other software bundles

Essential info

Price: £6,000 / $9,600 US
www.thefoundry.co.uk

OPERATING SYSTEMS
- Windows 7 (64bit) or above
- Mac OSX 10.7 (Lion), 10.8 (Mountain Lion), 10.9 (Mavericks) (64bit)
- Linux CentOS/RHEL 5 and CentOS/RHEL 6.4

OPTIMAL SYSTEM REQUIREMENTS
- Varies for each individual application. Check www.thefoundry.co.uk for details


Painting directly onto 3D geometry is easy in MARI, but you can also paint using traditional, flat UV spaces

The good & the bad

- ✓ Alembic file support throughout
- ✓ 42% off the individual price model
- ✓ Pipeline Integration
- ✓ One year maintenance, including support, updates and version upgrades
- ✓ File compatibility across various applications
- ✘ Installation process needs further development
- ✘ Multiple installation locations on HDD
- ✘ Locked to one machine ID

Our verdict

Features	9/10
Ease of use	8/10
Quality of results	9/10
Value for money	9/10

"This is a licensing package and the power is in the individual apps, but it's good value"

Final Score 9/10

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Samurai
Hasan Bajramovic

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Inside guide to industry news, studios, expert opinion and education

106 News
Industry news
We take a look at the latest stories, news, and events from the CG world

108 Industry insider
Doug Larmour
As global head of compositing at MPC, Doug Larmour gives us insight into life in post

110 Project focus
The Amazing Spider-Man 2
Jerome Chen tells us why the VFX of *The Amazing Spider-Man 2* were the most extensive yet

inside

> "I think audiences will be very happy with the level of action and adventure in this movie. It's tenfold from the last on so many levels"
>
> **Jerome Chen** VFX supervisor of *The Amazing Spider-Man 2*. Page 110

A still shot from The Amazing Spider-Man 2
Sony Pictures Imageworks VFX supervisor Jerome Chen explains how several sequences in the latest *The Amazing Spider-Man 2* took almost a year to produce

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Unity 5 is available for pre-order from the Unity store. Those who pre-order Unity Pro 5 will also receive Unity Pro 4

Unreal Engine 4 and Unity 5

Two of the biggest game engines gear up for the current generation

For more information on the new announcements, visit **www.unrealengine.com** and **https://store.unity3d.com**

At the Game Developers Conference 2014, Unity Technologies announced Unity 5 and made pre-orders of the new technology available from the Unity Store. Excitingly, only a few days later, Unreal Engine 4 was launched. Both have a huge array of new updates, with Unity 5 including features such as a new built-in physically based shader system designed to cover a wide variety of real-world materials under any lighting condition, plus the Enlighten-powered real-time lighting system, which enables the animation of lights, emissive material properties and control of the environment lighting in real time.

Meanwhile, Unreal Engine 4 aims to make the engine more approachable by providing access to the Unreal Editor in ready-to-run form, as well as the engine's complete C++ source code hosted on GitHub for collaborative development for a $19 per month subscription. New features comprise of support for advanced DirectX 11 rendering abilities, such as full-scene HDR reflections, thousands of dynamic lights per scene and artist-programmable tessellation and displacement. This is alongside a new material pipeline that makes use of physically based shading and the Cascade VFX editor, which provides the tools needed to create detailed fire, smoke and dust, as well as dirt and rubble.

CRYENGINE as a service

Crytek has also announced the launch of a subscription-based model for CRYENGINE with its Engine as a Service program, which means that CRYENGINE technology can be accessible to users for a fee of $/€9.90 per user per month, royalty-free. Useable features include the recently announced addition of Physically Based Shading, Geometry Cache and Image Based Lighting – an upgrade shown in action by Crytek at the Game Developers Conference.

Adobe states low net profit

Shift to online subscriptions may be the cause of a short term loss, but Adobe could be playing the long game

Adobe's latest quarterly results, published on the 18 March, show a net income of $47 million, down by 28% from a year earlier and marking the fifth quarter in a row in which the company has reported a drop in year-on-year earnings. However, the Creative Cloud subscription model does tend to lower revenue in the short term as fees are collected monthly instead of an upfront one-time payment, and this was a higher-than expected adjusted quarterly profit. In fact, Adobe exited Q1 with around 1,844,000 paid Creative Cloud subscriptions, an increase of 405,000 when compared to the number of subscriptions at the end of the Q4 fiscal year 2013.

These recurring Creative Cloud subscriptions, combined with Adobe Marketing Cloud, have now made up more than half of Adobe's Q1 revenue. Furthermore, despite this apparent low net profit, Adobe's shares have steadily risen by 63% over the past twelve months. Investors may be waging on the fact that while profits have decreased in the short term, the subscription model will attract many new customers in the long term and generate a steady revenue that comes from recurring sources.

The shift to a subscription model caused great debate, particularly after a cyber-security breach, where attackers obtained data on more than 38 million customer accounts in October

● **HAVE YOU HEARD?** ▪ Disney president Bob Iger has confirmed that *The Incredibles 2* is officially in development

Blender 2.70 released

Blender 2.70 is out now and it's free to download

New features for the latest version of the open-source 3D animation suite include initial support for volume rendering, including emission, absorption and scattering for render effects such as fire, smoke, mist and more. This is in addition to faster rendering of hair and textures. The motion tracker also now supports weighted tracks to keep results stable when features become difficult to track, and automatic feature detection has been made more robust with a new detector algorithm. In terms of UI improvements – which many have been very keen to see implemented – the toolbar now offers tabs to organise tools into categories. Multiple buttons can be edited at once, while Transform tools now have a mode to enter expressions and units. The Laplacian Deform modifier has also been added to pose a mesh while preserving geometric details, while the Blender game engine has been updated to support discreet levels of detail for meshes and support for working with PSD files.

Another change is the Threaded Dependency graph, which enables Object modifiers and Constraints to be computed with multiple threads, taking advantage of multicore processors

Virtual workstations

Could virtualisation democratise 3D creation?

Dell has announced the launch of its Workstation Visualization Centre of Excellence in Texas, with remote access capabilities where customers could potentially be able to experiment and develop remote and virtual workstation environments.

"Design and engineer professionals are more mobile than ever and they're working on projects with increasing complexity. These projects teams need to access data from anywhere and at any time," says Ben Cochran, senior architect for platform products. "We hope to provide the ability to run applications like 3ds Max on virtually any device, or via a web browser."

The Workstation Virtualization Centre of Excellence is now open in the Dell Solutions Centre in Texas. Dell plans to open additional sites globally

The OIAF calls for entries

The Ottawa International Animation Festival kicks off

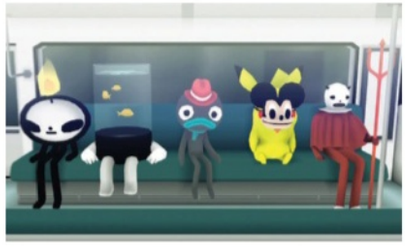


Image from 'The External World' by David OReilly, a central guest at this year's festival and one of the international jury members

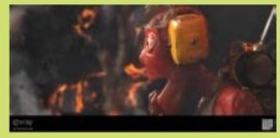
Animators are now invited to submit new work for the festival, which will take place in Ottawa, Canada, from 17 to 21 September 2014. New this year, in recognition of the fact that more series are being made on non-television platforms, the Series for Children and Series for Adult categories are no longer limited to television productions.

2014 entrants will also be able to submit their film via web link. As always, the OIAF does not charge entry fees, but all entries must be received by 16 May or for preview DVDs, 30 May.

Software shorts

Bringing you the lowdown on product updates and launches

V-Ray 3.0 for Maya Beta



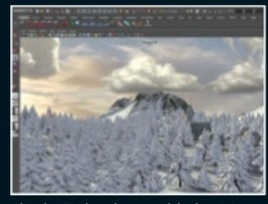
Chaos Group has announced that it is launching the V-Ray 3.0 for Maya Beta program, including features such as 15-times faster hair rendering, improved ray-traced sub-surface scattering, and a powerful new path-tracing engine that provides artists with instant feedback during the look dev process, . It will also support MARI's UDIM and Mudbox's UVTILE formats to make it easier for users to incorporate textures and common open-source formats such as OpenSubdiv, Alembic 1.5, Deep Images and OpenEXR 2.0. For the complete list of new features and upgrades, visit www.v-ray.com

RenderMan for KATANA

The Foundry and Pixar have announced the result of their recent collaboration: RenderMan for KATANA, which will be freely available for all KATANA users. Key benefits include support for the advanced features in RenderMan Pro Server 18 including path-tracing, geometric area lights, enhancements for interactive re-rendering and a sophisticated shader suite that can be used with both KATANA and RenderMan Studio. In addition, Pixar's image tool, known as 'it', is included as an alternate viewer from within KATANA. RenderMan for KATANA is available as a free plug-in for users on Linux and is compatible with RenderMan Pro Server 18 and KATANA versions 1.5 and 1.6.
For more information, visit www.pixar.com

Autodesk's latest apps

Autodesk unveils the 2015 versions of Maya, 3ds Max, Mudbox and Softimage



ShaderFX has been added to Maya and 3ds Max, enabling users to access a visual node-based system

Including the 2015 versions of Maya, 3ds Max, MotionBuilder, Mudbox and the very last Softimage, the update also comes with the latest Autodesk Maya LT, and a new emphasis on software rentals instead of upgrades. Key new features include XGen Arbitrary primitive technology, as well as BiFröst, a procedural effects platform developed after Autodesk purchased the rights to Naiad technology and united Naiad developers with the original ICE developers from Softimage. For more information about the 2015 suite, visit **www.autodesk.com**

DID YOU KNOW? ▪ *Mr Peabody & Sherman* topped the North American box office charts in its second weekend

Industry insider

Doug Larmour

Global head of compositing

While we wait to enjoy MPC's work on the upcoming *Godzilla*, we talk to Larmour about how his team of compositors are vital to the overall look of such films

About the insider

Job Global head of compositing

Location London

Company website www.moving-picture.com

Biography Doug Larmour has been a compositor in the VFX industry for 12 years. As MPC's global head of compositing he has supervised compositing teams on movies including *Pirates Of The Caribbean: On Stranger Tides*, *Prometheus*, *World War Z* and *The Lone Ranger*. He is currently overseeing global teams on *Maleficent*, *Guardians Of The Galaxy* and *Exodus*

To those outside the film industry, compositing is not particularly well understood. For Doug Larmour, it's a continually evolving challenge. He describes what he does as "the process through which we put all the different elements together to make the final image. It is the most photographic of the VFX arts, as in order to sell the final image as a real image, all elements must be brought together in a way that mimics a photographed plate. The simplest way to think about compositing is that it's a visual collage."

However, the process has been complicated in recent years. Larmour says that people want to make changes later and later, and "a lot of the 3D tasks have started to filter down into the compositing role. Particles, environment builds, deep holdouts and CG relighting can all be completed by the compositor these days as opposed to being completed by other disciplines. The compositor has to be much more a jack of all trades, while still retaining a good photographic eye." In fact, Larmour's advice to someone looking to get into compositing would be to "never assume you know how something should look, always look for reference. Research how the tools within the software package work. If you don't understand what is happening mathematically you'll never truly master the art."

What software do you use in your role?

Our main platform for compositing is NUKE. Since the demise of Shake, NUKE has consistently offered the best option for film compositing. It is constantly updated and improved by The Foundry. It works off Linux, which enables us to make use of a considerable render farm, and is fully Python-integrated, which gives us the choice to make a lot of our own improvements and plug-ins to improve its integration within the pipeline.

What's the biggest challenge compositors face today?

Time. Compositing is at the end of the VFX pipeline and as such, is subject to all the other departments delivering what they have before our work can truly begin. As with anything subjective in nature, when changes are made upstream it delays things to comp, yet the overall delivery deadline never generally moves that much. All of which means compositors generally get less time than they need to complete their job well. With overall schedules shrinking due to producers trying to save money, this only gets harder. Plus with the ability to change more in comp due to the improvements in software, compositors tend to find fitting everything that they need to do into the day the biggest challenge. At MPC, I would generally say that we get more time on a shot than most facilities, but that's generally because we have more to put in there and we have to make it look 100 per cent photoreal when it leaves, but even with more time, this is hard to achieve and takes an amazing attention to detail and a very focused and creative crew.

Which projects demanded the most of you creatively?

MPC has completed some amazing work on some of the biggest shows around and it is constantly pushing the boundaries of what is possible in VFX, so it's truly difficult to pick one show where the challenges were bigger than others. The goalposts constantly move. Recently I think that *World War Z* was a very big challenge. We had to develop a whole new pipeline for the crowd shots because of the way that the crowd needed to interact with each other. Usually when you're designing digital crowd you'll have an organisation to it that enables easy separation of layers, but with the way that the zombies had to climb over each other this was impossible, so we had to engage with a deep image pipeline to create the holdouts for all the dust and debris that the zombies created as well as the interaction they had with the environment. Although we'd used deep on several shows before this, we took it to new levels on this show.

Portfolio highlights

Some recent features that Doug Larmour has worked on:

2013 *World War Z*
2011-2010 *Harry Potter and the Deathly Hallows*
2010 *Clash of the Titans*
2007 *Harry Potter And The Order Of The Phoenix*
2007 *Sunshine*
2005 *Kingdom of Heaven*
2005 *King Kong*

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Back to Buster

Compositing is the oldest of the VFX disciplines, with in-camera tricks initially enabling the combination of several different elements

"Originally visual effects were done optically, as in Buster Keaton's *The Playhouse*, where the camera was physically blanked off in certain areas to only allow a part of the plate to be exposed upon. Once one bit of action was recorded, the film was rewound and a different section of the film was exposed with a different action. This process was continued until the whole of the film had been exposed upon and when the negative was finally developed it appeared as if there had been several Buster Keatons performing in the orchestra on a range of different instruments."

> "Research how the tools work. If you don't understand what is happening mathematically you'll never truly master the art"

A *Prometheus*, before Larmour and his team got their hands on it. Based in a futuristic dystopia, *Prometheus* required a variety of visual effects

B "When compositing, all the information you need is in the plate," says Larmour. "Check your plate and the surrounding shots before beginning"

C *Guardians Of The Galaxy* is another film that will feature work from Larmour and his compositing team. The Marvel epic is due to be released later on this year

D The sheer number of zombies featured in crowds in *World War Z* meant that this film was particularly challenging for the team at MPC

E *Godzilla* is one of a number of up-and-coming films that MPC is working on, and we can't wait to see what Doug's compositing teams have achieved

Project Focus

The Amazing Spider-Man 2

VFX supervisor Jerome Chen discusses the process behind Spider-Man's most extensive VFX yet

B

Project *The Amazing Spider-Man 2*
Company Sony Pictures Imageworks
Country USA
Bio Founded in 1992 in Calver City, California, Sony Pictures Imageworks has found great success over the years, having worked on many films, ranging from *The Matrix* all the way to *Men In Black*
Website www.imageworks.com

So, how exactly do you create a troubled character, mutated by an accident involving experimental eels, who now happens to have superhuman electrical powers? For Sony Pictures Imageworks this was just one of the many questions that needed answering in order to start work on *The Amazing Spider-Man 2*, which along with flying green men and mechanical rhinoceros battle suits sees Jamie Foxx turn into Electro, the stormy villain with an electrifying presence.

Even with the first film in the franchise under its belt – as well as Sam Raimi's *Spider-Man* series – the Imageworks team had its work cut out for it. Several sequences alone took almost a year to produce. "It's much bigger in scope than the last *Amazing Spider-Man*, so we're really excited about that," begins VFX supervisor for the film, Jerome Chen. "It was also probably five times harder than the first one. We had three new villains and all three of them had a component that was reliant on visual effects in order to complete their illusion, they weren't just a person in a costume or make-up."

For Jamie Foxx's character, this involved what the artists called the Electro skin treatment, or EST for short. Using references such as the skin of burn victims and footage of lighting inside storm clouds, the team needed to heavily augment the practical make-up Jamie Foxx wore during filming. "I really feel the creation of Electro was a great accomplishment," says Chen. "It gives audiences a really great villain to look at that's not just visually interesting, but also helps us understand part of his character. The effects work was just one part. On top of that, we had an animator study his motion and reproduce a virtual version of that in CG. All the muscles, underlying layers of energy and whatever other elements we had to render in the composite to create the ultimate effect had to line up perfectly.

"We've used motion capture extensively in the past, but for this show we decided to go with what the animators can do," continues Chen. "We found that motion capture works perfectly if you just want to drop it in place, but for a film where you need to transition it to some other type of action, it becomes more of a burden. The animators just did it all by eye."

Besides, Chen tells us, Spider-Man was actually fun to animate by hand. Predominantly using Maya, the Imageworks animators could really explore the character's movement, especially now that, unlike the first film where he was still learning, Spider-Man becomes more of an expert at using all his skills. "We

> "We had moments where he's almost like a skydiver, before he decides to shoot another web and swing"
> **Jerome Chen,** VFX supervisor

Contributors

Jerome Chen
VFX supervisor

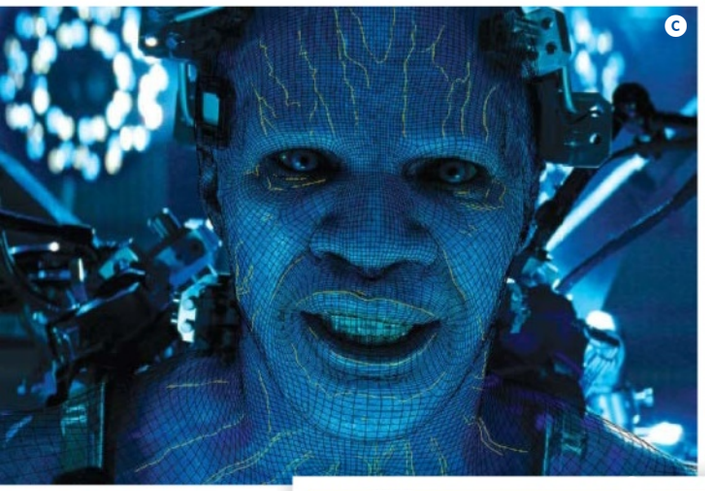
A

A "We have a lot of geometric assets through years of working on New York City, between *Men In Black* and the *Spider-Man* franchises, but it seems that every film we have to add more detail to help upscale the level of realism," says Chen

B The team developed patterns of lighting that would reflect Electro's emotional state. If he was brooding or considering things, the lighting would not pulse as fast, yet when he was very angry the lights would flicker much brighter and faster to reflect this

C The Imageworks team looked to sea creatures for inspiration, as Electro gains his power from to an eel. This resulted in a vivid and bright colour palette, with the character flickering from a relatively cool blue to a fiery red or orange

F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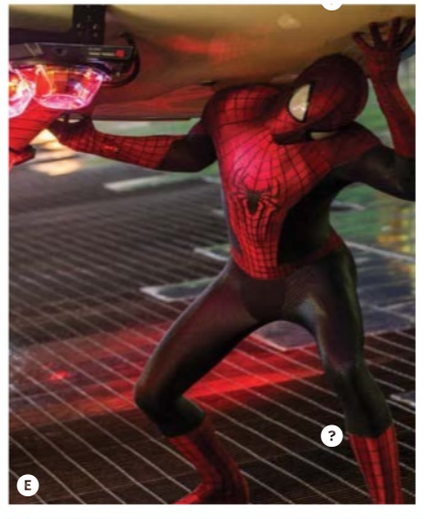
E

Filming in New York City

With Manhattan being such an iconic part of the Spider-Man story, Chen discusses giving the city a more prominent role in the sequel

"We shot the film entirely in New York from February until July. That gave us an opportunity to collect hundreds of thousands of pictures for reference, plus a lot of footage. Just walking down the street on a Friday afternoon, the dust is lit up in certain ways by the sunlight in between the buildings, and one of us would take a photo of it so we could try to incorporate that into a moment in the film with the CG. We actually did a laser scan of almost all of Times Square to get the real geometry, then we took extensive digital photography and spent six or seven months just texture-painting the sets and the store fronts and all the hundreds of thousands of details that make Times Square so interesting."

played with the fact that he's become kind of a daredevil, in a sense," continues Chen. "We had moments where he's almost like a skydiver before he decides to shoot another web and swing – the movie opens in a moment where he's just freefalling above the city as if he'd jumped from a plane. Those shots we really had a lot of fun doing, not just in dealing with Spider-Man's acrobatics. What's also new and different from the last movie is that the last one took place mainly at night, and here we wanted to feature Spider-Man in the day, swinging through New York City when it's alive and full of pedestrians."

It sounds like there's a great deal to look forward to. "Ultimately, I think audiences will be very happy with the level of action and adventure in this movie," concludes Chen. "It is tenfold from the last on so many levels."

D For lighting, the team created what they called Mesh lights – lights that take colours and make them their own light source. In Times Square, which is largely lit by jumbotrons, the team took the footage that was playing and used that as a source

E Imageworks animates predominantly in Maya, does effects and simulations in Houdini and now renders almost exclusively in Arnold, which it has customised to handle both sampling and the amount of data that the team needs to push through it

F "There's a full CG sequence at the climax of the movie where Electro fights Spider-Man in this spectacular light battle in this CG environment. There really is some truly wonderful animation in that scene," beams Chen

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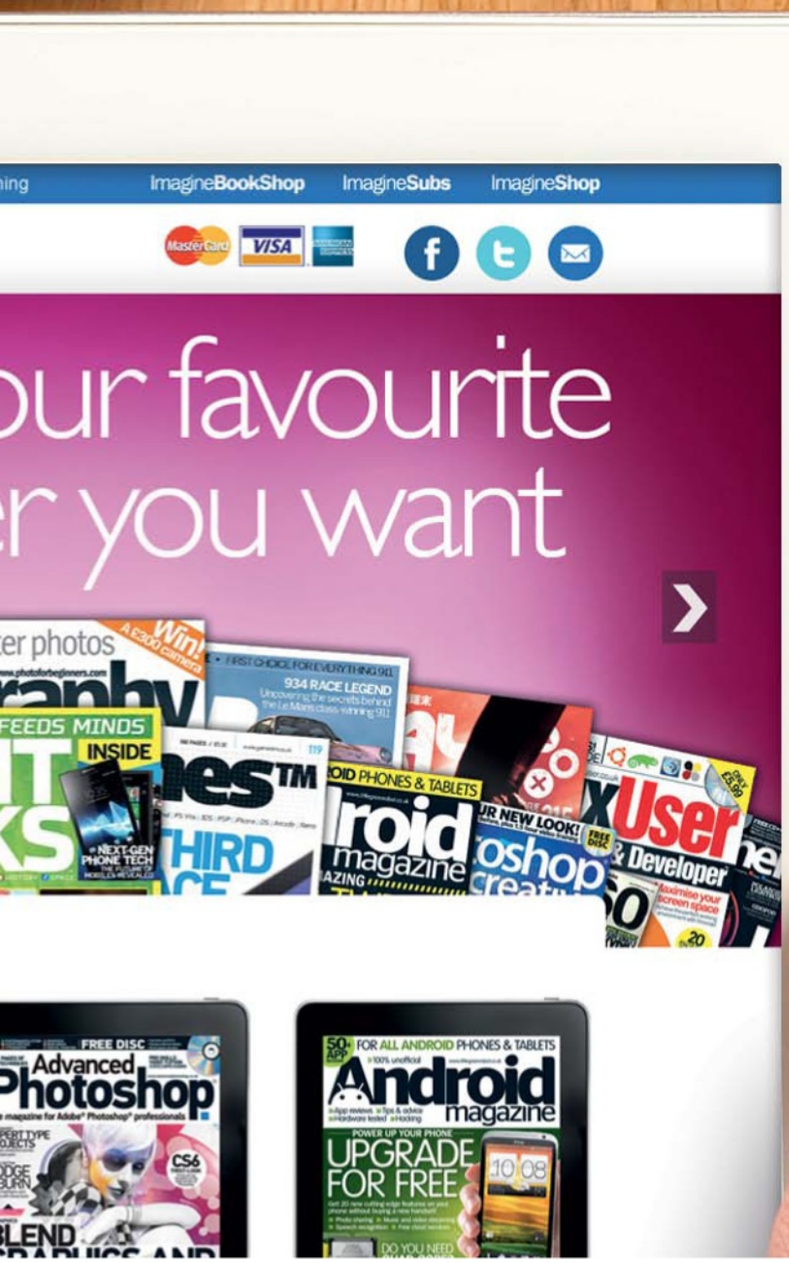

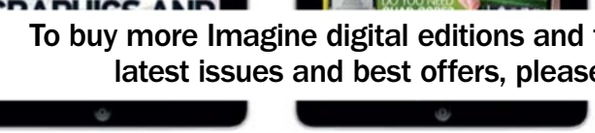

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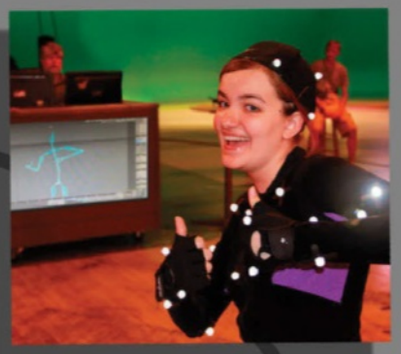

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